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WIRE FENCING.

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IT is curious how the custom of enclosing fields varies in different parts of the country. In Scotland, and generally throughout England north of the Thames, each field is separately fenced off in some way (hedge, wall, post and rail, wire), whereas on the Downs of Sussex, Hampshire, and Wiltshire, much of the country is quite open except for paddocks or meadows round the homestead. While it is possible that in the North the work of sub-division and enclosing has been overdone, in the South it is certain that fencing might be introduced or extended with great advantage.

The method of management of sheep flocks on the Downs is a very old one, and, in fact, appears to date from the rise and development of sheep-farming in England. A typical Down farm consists of an area of tillage land, on which crops are grown partly for sale and partly for consumption (folding) on the land by sheep, and an outrun of Down on which the sheep flock is daily pastured during a large part of the year.

A Down flock usually consists of 400 to 500 breeding ewes, attention to which entirely occupies the time of a shepherd and his young assistant. From 8 o'clock in the morning in summer, or 9 o'clock in winter, the flock is turned out to pasture on the open Down, the shepherd and his boy being in constant attendance to prevent the flock straying on to tillage land, or on to adjoining farms. North-country or Welsh sheep would probably thrive badly if constantly moved on, or checked, by dogs and men, but the more placid south-country breeds do not seem to mind the treatment, though the sheep would probably thrive better if free to move where they liked within a large enclosure, and to rest or to graze as they felt disposed.

At about 4 o'clock in the afternoon the flock is moved down to a fold which has been erected on tillage land, and there the sheep pass the night. The fold is constructed of hurdles, sometimes of netting, and encloses about an acre of some crop such as vetches, crimson clover, rape, aftermath, rye, barley, or mustard. Often, however, it is what is called "a bare fold," that is to say, it is erected on a summer fallow, and from 4 p.m. to 8 or 9 a.m. the sheep are penned in there, and get nothing to eat. The purpose of the bare fold is to provide a place where the sheep shall be secure for the night, and, incidentally, the land gets trodden and dunged by the sheep. It is evident that the manuring of the tillage land in this way is effected at the expense of the Down pasture, and as the custom has prevailed for centuries it is not surprising that the fertility of the Down grazings has reached a very low ebb.

Cattle are seldom seen on an open Down, for the sufficient reason that, without fences, they cannot be conveniently controlled. So seldom are cattle to be seen on a typical Down pasture that farmers have come to think that they cannot live there, and yet the opposite is the case, for not only do they thrive well, and give a good return in themselves, but they also greatly improve the sheep-sick land that has produced nothing but wool and mutton continuously for centuries. Of course, in its natural condition, the pasture of the Downs is poor food for cattle or any other stock, but if a dressing of basic slag is applied, it furnishes herbage of high feeding quality for all farm animals. In the writer's experience a "slagged" Down will in a normal year produce tegs and lambs quite fit for the butcher without any artificial feeding, while steers come into the yards in October in very forward condition. It is probable that no class of land, represented in England on a large scale, is more immediately and profitably responsive to improved treatment, and yet it is, on the whole, rare to find anything being done.

While the enclosure of Down land by fencing is not an absolutely necessary preliminary to its improvement, it may at least be said that the full benefits will not be secured while the land is unenclosed. Apart altogether from its bearings on manurial treatment, the fencing of a Down at once sets free a man and boy for other useful work during a large part of their time. Moreover, it obviates the necessity for shutting up the sheep nightly in a fold, and allows them to graze late and early, as sheep instinctively do, to their great advantage.

Presumably it is the initial expense that deters farmers from more generally fencing their Downs, and yet this need not be so great as is usually supposed. The cost of fencing depends to a large extent on the shape of the area; for a given area a square requires less fencing than an oblong or triangular area. To take the average case of a Down 1,600 yd. long and 800 yd. wide; this means an area of 264 acres, and necessitates 4,800 yd. of boundary fencing. In normal times an efficient post and wire fence, with a reasonable supply of gates, can be erected for 4½*d.* per yd., or a total of £90; and for another £15 a transverse fence can be put up dividing the area into two fields of 132 acres each. This works out at a capital expenditure of about 8*s.* per acre. The wire, if solid and galvanised, will last for a great many years, but even assuming that the whole fence has a life of only 10 years, it means a sinking fund at 4 per cent. of only 1*s.* per acre per annum (including interest), or £13 4*s.* per annum in all, an expenditure that will never fail to be well repaid.

If, instead of costing 4½*d.* per yd., the fence, with the necessary gates, cost 6*d.* per yd., the total expenditure for the two fields would be £140, or about 10*s.* 6*d.* per acre, necessitating a sinking fund to redeem in 10 years of 1*s.* 3½*d.* per acre per annum (including interest), or a total charge of £17 per annum.

The following is a brief description of some of the tools which will be required: it may be said that no others are likely to produce better work and at the same time be simpler or cheaper:—

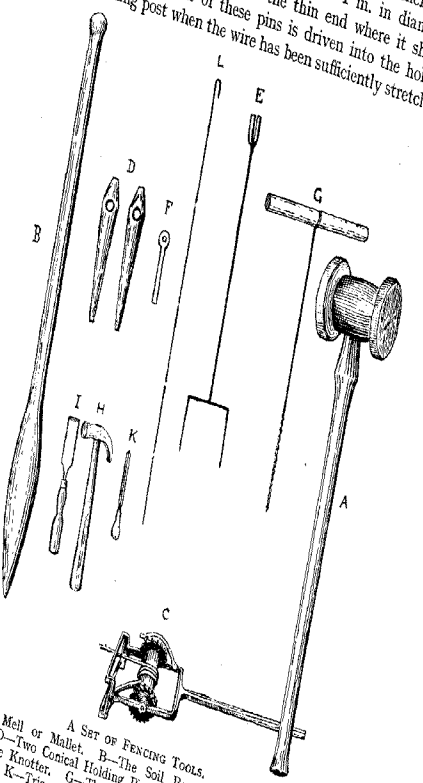
The Mallet or *Mell* (A in Fig.) is of cast iron, weighing 14 lb. It should have a handle or shank 40 in. long of sound hickory or ash. Price with handle 3*s.* 6*d.*

The Soil Borer (B in Fig.) is 4 ft. long, of malleable iron and weighs 14 lb. The so-called "Pitcher" that a south-country shepherd uses for setting his sheep-fold, although sometimes rather too light, will generally answer the purpose. Price 3*s.*

The Ratchet Wire Strainer or "*Monkey*" (C in Fig.) is a simple winch with a barrel about 2 in. in diameter, through which a hole passes to receive the end of the wire. This is the most satisfactory tool for the purpose, and with it one can put on a strain that will break any fencing wire. Price 17*s.* 6*d.*

Two Conical Malleable Iron Pins (D in Fig.) each weighing 1½ lb., and of a total length of 12 in., namely 9 in. from the

point to the hole, and 3 in. from the hole to the thick end. At the thickest part each pin should be 1 in. in diameter, and should taper gradually to the thin end where it should be $\frac{3}{8}$ in. thick. One of these pins is driven into the hole in the straining post when the wire has been sufficiently stretched,



A SET OF FENCING TOOLS.

A—The Mell or Mallet. B—The Soil Borer. C—The Strainer or Monkey. D—Two Conical Holding Pins. E—Holder for Knotting Wire. F—The Wire Knotter. G—The Auger. H—The Claw Hammer. I—The Chisel. K—Triangular File for Cutting Wire. L—The Wire Spacer or Gauge.

and in this way the wire is held tight and prevented from slipping while the monkey is pulled off. The pin must, therefore, be considerably larger at its thickest part than the hole bored in the post. It is well, too, to have it slightly longer, from the thickest part to the small end, than the diameter of the post into which it is driven, so that the thin end may project

slightly beyond the post. When the wire has been stapled round the post it is a simple matter to loosen the pin by striking it with a hammer on the projecting thin end, and, when it has been loosened, its removal is accomplished by putting the thin end of the second pin into the hole in the first pin and rotating it backwards and forwards a few times, when it can easily be withdrawn. It is evident, therefore, that the hole in each pin must be large enough to receive the small end of the other pin. Price per pair 2*s.*

A Holder for Knotting Wire (E in Fig.). This consists of an iron rod $\frac{5}{8}$ in. thick and 2 ft. long. It has at the lower end two prongs, 4 in. long and 6 in. apart, which are pressed by the feet of the worker into the ground, so that it will stand erect. The upper end has a fork or slot $\frac{1}{4}$ in. wide to receive the wire and hold it tight in the process of knotting. Price 2*s.*

The Wire Knotter (F in Fig.) is 6 in. long and $\frac{1}{2}$ in. thick, flattened at one end where it is pierced by a hole large enough to receive up to, say, No. 4 wire, and thus it will also take smaller sizes. When the wire has been placed in the slot of the holder it is a simple matter to wind the end, passed through the hole in the knotter, round the main strand of wire and thus make a loop knot. Price 6*d.*

Scotch Eyed Auger (G in Fig.) making a hole of $\frac{3}{4}$ in. This is used for boring the holes in the straining posts. Price, with handle, 2*s.*

A Claw Hammer (H in Fig.) which should be of steel so that the claws can be sufficiently thin to pass easily behind the wire and the stob or post in drawing a staple already driven home. The hammer should weigh at least 1 lb., because it has to be used not only for driving staples, but also for knocking in the conical iron pins to hold the wire in the straining posts. Price 2*s.* 6*d.*

A Strong Chisel (I in Fig.) 1 in. wide, which is used to make the notch in the straining posts, into which the end of a stay is fitted. Price 1*s.*

A Small Triangular File (K in Fig.), used for making a notch in the spare end of the wire after a knot has been completed, and for cutting wire generally. If the wire is about one-eighth cut through, the end easily breaks off. Price 3*d.*

The Wire Spacer (L in Fig.), made out of fencing wire of average gauge, say, No. 6. A piece of wire is bent $1\frac{1}{2}$ in. at the end in pot-hook fashion, so that it can be conveniently hung on the top wire of the fence. The distances between the lower wires, say, for a six-wire fence, 10 in., 8 in.,

7 in., 6 in. and 6 in., are then marked on the spacer with a file, the spacer being cut off so that when it is hung on the top wire its lowest point will indicate the position of the lowest wire. With the spacing shown above, the distance from the top wire to the bottom one would be 3 ft. 1 in. The spacer is a most useful contrivance, and as one staples any particular wire it is moved along from stob to stob and automatically shows where the wire has to be stapled. It is hung on the top wire, so as to come on the opposite side of the fence from that on which the fencer is working. The marks should, of course, be on the side of the spacer to face the worker. In stapling it is convenient to move along with the fence on one's left side, so that the left hand may move the spacer from post to post, while the right holds the hammer. This saves the trouble of turning round every time a staple is driven in. Sometimes a fencer is seen measuring with a foot rule and marking the position of the wires on each stob. This is a serious waste of time.

A Spade with a 7 in. face is necessary for making the straining-post holes, and for other purposes, while a cold chisel is also convenient for cutting staples already driven home in a straining post, though it is only in exceptional circumstances that it will be required.

The Wire may be solid or strand, but, on the whole, the former is to be preferred. The extra expense involved in having the wire galvanised is fully justified. If one gauge of wire only is used No. 6 is the best, though No. 5, or even No. 4, for the top wire is advisable if heavy stock, and especially horses, are to be restrained. No. 8 is the lightest gauge that is really efficient against stock. Barbed wire may be useful in some districts, but near the coast it is soon attacked by rust. The cost of solid galvanised annealed wire is usually about £12 per ton, though at present it is £20.

The Staples should be of galvanised No. 8 wire and be 1½ in. long. They cost about 5s. per 1,000.

Wooden Straining Posts are usually either of larch or oak, but they may be of Spanish Chestnut, False Acacia, or any other timber that is sufficiently durable. Their length depends on the height of the fence, and whether they are to be used as gate posts. Some people will not use a straining post for hanging a gate, preferring to put in a special post for the purpose. If a straining post when inserted in the ground is not absolutely immovable it certainly will never be satisfactory as a gate post, but there is no reason why it should ever move if properly fixed. The straining of the fence and

the pull of the gate counteract each other, and, in this way, are mutually advantageous. If a gate is not to be hung, the post need not be more than 7 ft. 9 in. in length, that is to say, 4 ft. in the ground and 3 ft. 9 in. out. If the post is to be inserted in a dip of the ground it may have to be 6 in. or even a foot longer. If the wood is good, a minimum thickness of 6 in. at the thin end will suffice. A straining post weighs ¾-1 cwt.

The Intermediate Posts (called also Prick Posts, Pointed Posts, Stumps, Stobs, etc.) may be of larch, oak, or Spanish chestnut, or of some inferior wood if creosoted. They may be round, split, or sawn, but in all cases they should have the bark removed. If round they should have a minimum diameter at the small end of 2½ in. for a light fence, or 3 in. to 3½ in. for a heavier one; when sawn or split the cross section at the small end should be at least 6 sq. in. The length will depend chiefly on the height of the fence, but if the ground permits they should be driven in 1½ ft., or even more in very soft soil. With 18 in. in the ground and 42 in. out this means a total length of 5 ft. A stob with a long tapering point is more easily driven into the ground than one with a more abrupt point, but, remembering that the weak part of a stob is just below the surface of the ground, the pointing should be done so as to leave the stob the full thickness there. The weight usually varies between 10 and 15 lb.

The Stays may be of split or sawn oak, or of round larch or Spanish chestnut, and should be cut 8 ft. long, and have a minimum thickness at the small end of 3 in. It is a great mistake to use short, say 5-ft. stays, because if the end is fixed against the post above the top wire, such a stay does not offer sufficient resistance to the strain, and if placed against the post below the top wire the tendency for the post to be lifted out of the ground is greatly increased.

In giving the following description of the method of erecting a wire fence, it is well to point out that a paper description is a poor substitute for a few days as assistant to an experienced workman. On the whole it is best to begin operations by inserting the straining posts in their positions, and if there are any bends or dips in the fence that require dug-in posts, it is well also to have them placed in position before the stobs are inserted. The success of the fence depends to a very large extent on the way in which the straining posts are fixed, because if they "give" to any appreciable extent the fence rapidly becomes slack, and even if the wire is re-strained a few months later it will soon get slack again. Any straining

post can be fixed immovably in a hole 4 ft. deep, and, in fact, if it is difficult to get the post deeper than 3½ ft. this depth will prove sufficient provided a little extra care is given to the details of fixing.

Every straining post should have an "anchor" fixed near its base. This consists of a piece of sound wood about 3 ft. long and 3 in. or so in thickness, which may be round or squared: on the whole it is better squared. With the saw a notch about 2 in. deep is cut within 3 in. of the base of the post, the piece of wood taken out being of such a width that the anchor fits exactly into the slot, so that when it is driven home it is firmly held. To make all secure a 4 in. nail may be driven through the anchor to hold it immovably in position. It does not at all matter whether the anchor or cross piece projects equally on each side of the post or whether the whole of it projects from one side. The hole in the ground to receive the post should be about 3½ ft. long and 12 in. to 15 in. wide, according to the size of the post, but there is no need to throw out more soil than is sufficient to allow the post to be easily inserted. If the end of the fence comes close up against another fence running at right angles, or against a wall or building, the trench for the insertion of the post should lie in the direction of the line of the fence, because only in this way can the terminal post be placed close to the pre-existing fence, building, or wall. If, on the other hand, the end of the fence is a gateway, the trench to receive the post had better be at right angles to the line of the fence; the anchor will then project equally on both sides of the post.

Having dug the hole and ascertained that it is approximately of the right depth, the post with its anchor attached is carefully dropped into the hole, with its centre exactly in the line of the fence. This having been done, a few spadefuls of soil are thrown in and carefully rammed round the foot of the post and along the side of the anchor. In order to get the soil into all the corners and angles of the hole the rammer should not be more than 2½ in. in diameter, and if the post so fills the hole that there is not more than 1 in. or 2 in. of clear space between the sides of the post and the sides of the hole, the rammer for use in packing that part of the hole should not be more than 1 in. in thickness, a piece of wooden rail 3 in. × 1 in. being useful for the purpose.

Having satisfied oneself that the position of the post is right, more soil is filled into the hole, one man shovelling

while another confines himself to packing and ramming, sufficient time being given for the latter to do his work thoroughly. The secure fixing of the post is very largely a matter of thorough packing of the soil, and if a few stones 2 in. to 3 in. in diameter are available they should occasionally be thrown on the soil close to the post and be beaten in. After the filling of the trench has proceeded to the depth of about 1 ft. or so, it is necessary to see once more that the post is perfectly perpendicular, because later it is impossible to rectify a mistake of this kind.

The trench having been filled and thoroughly rammed, the next thing to do is to fix the stay. If the post is a terminal one a single stay is, of course, all that is necessary. Even where the post is an angle one, that is to say, where the line of fence makes a right angle, more or less, at the post, some workmen, by way of economising, put in a single stay, so as to bisect the angle, but such a practice is not to be recommended, because the stay projects into the field and may possibly trip up stock. It is much better to insert two stays at an angle post, each of which will lie along the line of its respective fence. The stays must be sufficiently thick and strong to obviate any chance of bending when the pull of the fence is brought to bear upon them; but a stay 4 in. thick at the butt and 3 in. thick at the other end will suffice if it is of larch, oak, or Spanish chestnut.

A notch 1 to 1½ in. deep is cut with a chisel rather to one side of the median line of the post, and about 2 in. below the point where the top wire will come. This having been done, and the end of the stay having been prepared so as to fit accurately into the notch, the other end is put on the ground at approximately the spot where it will ultimately be fixed. A bevelled hole about 15 in. deep is now made in the ground with a spade, and it is a good plan to make an allowance for a big stone or rough block of wood, say 15 in. long and 6 in. in section, to be placed transversely at the end of the stay, and about 6 in. below the surface of the ground. A little "humouring" will be necessary in order to get the supporting block or stone into its proper position, but the great thing is to see that the position is rather too near than too far from the straining post, because if it is too near it is easy to dig out a little more soil and let the block go back a trifle; and, finally, by using the stay as a battering ram it can be beaten tight against the undisturbed back of soil, and the other end of the stay can be accurately let into the

notch in the straining post. The fixing of the stay in position may be deferred until the stobs are inserted, but this is a detail of little importance.

Having fixed a straining post at each end of the fence, or a post at one end and an intermediate post with a temporary stay in its proper place, the next thing to do is to get the stobs inserted. If the fence is perfectly straight, one may stretch a wire from post to post, but if the fence is at all curved the line is better marked off by string or cord. Where a curve occurs in the fence the cord must be laid fairly loosely round this bend, being kept in position at intervals of a few yards by means of pegs. Unless the cord is fairly slack it cannot be made accurately to follow the curve without the use of an excessive number of pegs. As a matter of fact the man who makes the holes for the stobs depends to some extent on his eye to determine their actual position round the bend.

The distance from stob to stob depends upon circumstances; for a very substantial fence the intervals should be 6 ft., whereas for a lighter fence 9-ft. intervals will suffice; while for a light, straight fence to turn sheep and young horned stock, stobs at 36-ft. intervals, with 3 droppers between at 9-ft. intervals, will often prove sufficient (the so-called Corymony fence). Whatever the distance selected it is well to put in the stobs at 6-ft. intervals when negotiating curves, and in this case the stobs must either be propped to resist a thrust, or tied down to stumps with wire to resist a pull. If this is not attended to the fence cannot possibly remain tight for any length of time. If the curve is at all sharp, and especially if it has anything of the nature of an angle, a post must be dug into the ground at that place. Such a post, however, need not be so strong as a straining post, nor need it be put into the ground to a greater distance than $2\frac{1}{2}$ ft. to 3 ft. It must be well propped or tied back, as the case may be. When a fence goes over an abrupt knoll it is a good plan to bore the stobs there and to pass the wire through. Staples are apt to be drawn out of the stobs at such a place by the strong downward pull of the wire. Where a fence crosses a sharp dip in the ground it is essential that a carefully anchored post be dug in and the wires passed through it. If the dip is less abrupt it will suffice to tie down all the stobs at that place. Droppers are unsuitable in crossing dips and knolls.

The cord having been put in position over a length of about 100 yd., the holes for the stobs are then made at the necessary intervals by means of the soil borer, which should be inserted

to a depth of some 15 in., the stobs themselves being driven into the ground to a distance of about 1½ ft., a little more or less depending upon the character of the soil. For turning sheep and light horned stock, a fence 3 ft. 6 in. from the level of the ground to the top wire is sufficient, so that a 5-ft. stob would allow 2 in. above the top wire, 3 ft. 1 in. between the top and bottom wires, 3 in. between the bottom wire and the level of the ground, and 1 ft. 6 in. in the soil.

The holes for the stobs having been made, the process of driving them in may be taken in hand. For this purpose two men are necessary, one to use the mell and the other to keep the stob in a vertical position, or, in the case of a bend, with a slight inclination out or in, as the case may be. The guiding of the stob can be conveniently done by means of a claw hammer, by the aid of which one of the workers either pushes or pulls, as may be necessary. In the first instance the stobs are driven home only approximately to their proper depth. The great thing is not to drive them too far in, but rather to leave them about 2 in. higher out of the ground than will ultimately be necessary.

Having got the stobs roughly inserted in this way, it is next necessary to bore the straining post at the points corresponding with the interspaces between the wires. By applying his eye behind the straining post and looking along the line of the fence, the workman can see exactly where the top hole should come on the straining post, and measuring downwards from there the position of the other holes is determined. For a 6-wire fence a satisfactory spacing would be 10, 8, 7, 6, 6 in., with 3 in. between the lowest wire and the surface of the ground. Should a hole happen to come where a knot occurs on the surface of the post, the auger must be entered with great care, or otherwise the point is apt to be broken off. In the case of a fence of such a length that there is only one intermediate straining post between the terminals it is unnecessary to bore the intermediate post, the wire being attached to it by being wound round. If, however, the fence is so long that there are two or more intermediate posts, then some or all of these must be bored, and must be temporarily stayed until the fence is continued beyond, and thus takes the strain off the post.

Straining posts are, as a rule, put in too close. A wire fence may be quite well strained over a distance of 250 yd.; in fact, within reasonable limits, the longer the strain the tighter do the wires remain. On the other hand, one often

sees wire fences with straining posts every 50 yd. or less, an arrangement that means considerable increase in cost without any advantage whatever.

Having put in the posts and stobs, the next thing to do—unless wire had already been used instead of cord to get the line of the fence—is to run out the top wire from the coil. This may be done in a variety of ways. Probably the best method is to put the end of the wire through the top hole, where it is held in position by lightly driving in one of the tapering bolts, and then to run the coil along the line of fence, the wire, of course, being paid out as the uncoiling proceeds. Having got to the further post the wire is cut, leaving sufficient to go round the post, to which it is fastened by means of 3 staples, this being quite a sufficient number if the wire makes the full circumference of the post. Some run out the wire in another way, namely, by keeping the coil stationary at one of the terminal posts, a man taking an end of the wire and walking away with it along the line of fence, the man at the coil paying it off in loops. The main objection to this plan is the possibility of the wire slipping out of the hands of the former workman, when it would instantly get ravelled. If there is much fencing to do it is worth while to construct or purchase a turntable mounted on a wheelbarrow. The coil is placed on the turntable and the wire is run out in a simple and most satisfactory manner.

If it is necessary to join two wires, one end is put into the wire holder, and by means of the knotter a neat loop is made; the end of the other length of wire is then passed through and similarly looped, the ends being cut off close, so that possible injury to the clothes of anyone crossing the fence, or to stock, is prevented.

Assuming that the first method of running out the wire, above described, has been adopted, the workman returns to the straining post at which the wire had been temporarily held by means of a tapering bolt and puts the end of the wire through the hole in the barrel of the monkey. When the grip has been well secured the tapering bolt is removed from the post, and care is taken that neither of the cross pieces of the monkey is so near to the hole through the post as to be in the way of the tapering bolt which is ultimately driven into the hole. The monkey is then worked so as to get a severe strain on the wire, and when as much pressure has been put on as is desirable the second worker goes half way along the fence, catches the wire with both hands, and

pulls sidewise, not exactly with all his might but still exercising heavy pressure. When this has been done it will be found that the barrel of the monkey can be wound for two or three more notches; a further sidewise pull on the wire will induce a little more distention, and so another notch or two is gained. When the first wire has been strained to its utmost capacity, it is very important that about half a dozen heavy blows should be given to the straining post on the side away from the line of fence. This anticipates the post and stay "giving" afterwards, and has much influence in securing a tight fence.

Leaving the monkey on the post with the wire attached the stapling of the wire on the stobs may now be proceeded with. It is a mistake to put the top wire too near the top of the stobs, as this only results in the stobs splitting to a greater or less extent when the staples are driven in; 2 in. or 2½ in. is near enough to the top of the post for the top wire to come. The staples should be driven in so that they cross the wire exactly at right angles. In this way friction, when further straining is put upon the wire, is reduced to the minimum. If owing to a knot in the wood the staple is slightly skewed, the claw hammer should be used to give it a twist so that it stands precisely at right angles to the wire. The staples should be driven in so as to leave the wire quite free. It is a common and serious mistake to drive the staples home so that they "bite" the wire; this tends to "nick" the wire and weaken it at that point, and, further, it interferes with the tightening of the wire on any subsequent occasion. Moreover, this method of stapling adds nothing to the tightness of the fence, and nothing so obviously indicates the work of the amateur.

Having got the top wire stapled the next thing to do is for one man to take the mell, and the other to follow him at a distance of 10 or 12 yd. and to indicate which stobs still require driving further into the ground. It can at once be seen which stobs require attention, whether it be merely a light tap or two, or whether more serious driving. If a stob has its point upon a rock or stone so that it cannot be driven in further, or if its head is cracking seriously owing to the use of the mell, it is a mistake to try to force it further into the ground, and such a stob should be cut off with the saw at the proper height.

The stapling of the top wire, and the supplementary driving in of the stobs will still further have slackened the top wire, so that it can now stand a few more notches of the monkey. If, while one man works the monkey the other goes along the fence and with a stob strikes the top wire at intervals

of five or six paces, the wire can be still further tightened up. The great thing, so long as the monkey is attached to the wire, is to see that the wire is strained to its maximum extent, because if this is not attended to now it will mean that in a very short time it will have a tendency to become undesirably slack.

While it is well to have all the wires very tight to begin with, it is not suggested that they should be strained to breaking point, and it is rare that a break occurs in first-quality wire. If, through any cause, a wire breaks in the process of straining, the monkey must be pulled off, the wire pulled out of the post to such an extent as to leave only enough for the monkey to grip, and the broken ends are then joined by knotting.

Having tightened the wire as much as is deemed desirable, it is next necessary to get the monkey off, and the wire stapled round the post. To do this care is taken that the catch of the monkey that pushes against the cogged teeth of the barrel is so far removed from the particular cog in which it is resting that only about one-half or so of the cog grips the catch; or, better still, the catch can be thrown back altogether and the second worker can hold down the end of the handle and thus keep the full strain on the wire. Next, one of the conical bolts is driven into the hole of the post through which the wire passes, the bolt being inserted from the side opposite to that against which the monkey rests. The wire ought to be pressed between the bolt and the *side* of the hole, not the top or bottom, or otherwise it is driven into the fibre of the wood and the grip is not so secure, as it is apt to cause a certain amount of splitting of the post. How far the bolt will have to be driven in is a matter of experience. Old wire, with its rougher surface, is much more easily held than new wire, and the same remark applies to strand as compared with solid wire. After the bolt has been driven in as far as is thought desirable the man who is holding down the handle of the monkey gradually raises the handle to see whether the wire is effectively gripped by the bolt. If this should prove not to be the case, the bolt must be still further driven in. When all is secure the monkey is simply drawn off the wire, and the latter is stapled round the post, three staples being driven full home, to bite the wire. The wire is then cut about an inch from the third staple and slightly bent back in a fish-hook-like fashion, so as effectively to prevent any possibility of its slipping.

The placing of the other wires in position proceeds very much as in the case of the top wire, and when the stapling

stage arrives the gauge or "spacer" is hung on the top wire and the first mark shows the exact position upon the stobs where the second wire is to be stapled, and so on with the other wires.

Cost of Erecting 2,020 Yards of Fencing in the Spring of 1914.*

During February, 1914, the writer had occasion to erect 2,020 yds. of fence, and as all the wood and other material had to be purchased, and a careful note was kept of the time of men and horses, the cost can be stated with absolute accuracy.

The surface of the ground was fairly even, though undulating, and, on the whole, the stretches between straining posts were fairly long, in two cases up to nearly 300 yd., the average being about 200 yd. The soil consists of about 9 in. of loam over chalk, and, in places, is rather hard to dig or bore. The ground is about 1 mile from the homestead, and about a similar distance from the railway station. Beyond a day's work in demonstrating operations the writer was unable to do anything himself, and the men who erected the fence had never performed such work before. But they were intelligent and diligent, and rapidly picked up the details of the processes. The fence has now been up for more than a year, and it is proving to be a sound piece of work, which should have a long "life" before it.

The fence consists of 6 wires, the top one being No. 6 gauge, while the others are No. 8.

Where the fence is straight, round, unpeeled Spanish chestnut stobs, 5 ft. 3 in. long, and about 3 in. thick at the small end, were driven in at 36-ft. intervals. These cost 3*d.* each on rail. This spring (1915) 10½-ft. chestnut poles, minimum diameter 3 in. over bark at small end, could be obtained at 25*s.* per 100 f.o.r. When these are divided they make two 5-ft. 3-in. stobs at exactly 1½*d.* each, to which has to be added the cost of cross-cutting and pointing, which would certainly not cost another 1½*d.*, so that 3*d.* seems quite a full price for the stobs actually used in the fence that is being described. The number theoretically required for 2,020 yds. of fence is 168, but as they had to be put in closer round curves, 266 were actually used.

In regard to the cost of preparing round stobs from larch thinnings, the following contract rates prevailed before the war on an estate in Scotland:—

1. Cross-cutting, peeling and pointing stobs 5 ft. 6 in. long, 3½ in. diameter at small end, 1*s.* per dozen.

* It must be emphasised that pre-war prices are quoted.

2. Cross-cutting and pointing (no peeling) stobs 5 ft. long, 2 in. to 2½ in. diameter at small end, 3*d.* per dozen.

3. Cross-cutting and pointing (no peeling) stakes for sheep netting, 5 ft. long, 1¼ in. to 1¾ in. diameter at small end, 2*d.* per dozen.

The writer's original intention was to have three wooden droppers between each pair of stobs (Corymony fence), and a quotation was obtained for these, 39-in. × 1-in. Baltic yellow deal at 1*d.* each. It was found, however, that split ash "spiles," 5 ft. long, dipped in creosote, could be obtained at 1*d.* each f.o.r., and as they would give additional strength to the fence, it was decided to use them. Theoretically, the number required is 505, but actually 423 were used, for the reason explained above, that a large curve in the fence necessitated the use of an extra number of heavy stobs.

The dug-in posts consisted of 15 strainers, 2 holders (for getting round bends), and 4 exclusively for gates. They were obtained by splitting oak logs about 15 in. in diameter into four, and many of them weighed over 1 cwt. each. Although rough, they are very strong, and will probably last for from 30 to 40 years. They would appear to be rather under-priced at 1*s.* each, the price paid for them.

Professional fencers would have erected the fence in less than 15¼ days, but, on the other hand, they would have expected more than 3*s.* per day in wages, so that £7 11*s.* 6*d.* may be regarded as a fair price for the labour.

The following is a detailed statement of the cost of the various items:—

	£	s.	d.
19 cwt. No. 8, and 5 cwt. No. 6 solid annealed galvanised wire at £11 10*s.* per ton, carriage paid	13	16	0
5,000 galvanised side-cut staples, 1½ in., No. 8 gauge, at 5*s.* per 1,000	1	5	0
266 Spanish chestnut stobs, 5 ft. 3 in. long, at 3*d.*	3	6	6
423 split ash "spiles," 5 ft. long, ends dipped in creosote, at 1*d.*	1	15	3
21 rough split oak straining, holding, and gate posts, 7 ft. 6 in. long, at 1*s.*	1	1	0
16 Spanish chestnut stays, at 4*d.*	0	5	4
111 yards split ash "runners" for special places	1	1	9
Carriage on wood at 7*s.* 10*d.* per ton, for 30 miles	2	10	0
3 gates at 5*s.* 9*d.* and mountings at 6*s.* 6*d.*	1	16	9
2 horses for 2 days, and 1 horse for 1½ days, carting wood and wire at 2*s.* 6*d.* per horse per day	0	13	9
Carters' wages, a man and boy for 2 days, 1 man for 1½ days	0	12	6
Manual labour erecting fence, 2 men 15¼ days at 3*s.* .. .. £ 4 11 6			
Proportion of bailiff's time 3 0 0			
	7	11	6
	£35	15	4

From the detailed statement it will be found that the cost works out at exactly 4¼*d.* per yard, including 3 gates and some paling ("runners.") Excluding these items the cost comes to less than 4*d.* per yard, made up as follows :—

	£	s.	d.		
Wire and staples.. ..	15	1	0	= 1·78	pence per yard.
Wood, including carriage	8	18	1	= 1·06	" "
Carting materials ..	1	6	3	= 1·06	" "
Labour erecting fence ..	7	11	6		
Total ..	£32	16	10	= 3·90	" "

While one can easily imagine circumstances where the cost would be increased, one can as easily picture conditions where the outlay would have been less. In point of fact the fence in question followed an S-shaped bend for some 400 yards, necessitating the tying back and propping of many of the stobs, and the use of more stobs (as contrasted with spiles) than would have been required for a straight run. Moreover, there were three short lengths, which rendered it necessary to use two extra straining posts, but on the whole the fence may be regarded as fairly typical of that required on the Downs of a Southern county.

INFLUENCE OF THE WAR ON SUPPLIES AND USE OF FEEDING STUFFS.

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THE problem of the maintenance of an adequate supply of feeding stuffs during war time is an interesting, though complicated one, and the stock feeder, in view of the instability of the market and uncertainty of delivery, must be prepared to grapple with any new situation that may arise. The present position with regard to live stock is a reassuring one. Although there is an actual slight decrease in cows and breeding sows, the total number of live stock kept, as evidenced by the recent returns, is greater this year than last, and this would indicate that the stock feeder has the utmost confidence in the adequacy of future supplies of feeding stuffs.

There is every reason to believe that factors other than actual shortage are responsible for the present prices. Unfortunately for the farmer, most of the feeding stuffs of agricultural importance, and particularly the oil cakes, are by-products in the manufacture of other materials, and the

manufacturer has to be convinced of the commercial success of the principal product of manufacture before he will risk his money in the laying down of expensive crushing plant. A rise in the price of feeding stuffs is not, therefore, always followed by an increased production, although the raw material may be in abundance, and a temporary serious shortage may occur without any apparent explanation to account for it. The present high prices of the well-known oil cakes are to a large extent due to this factor. Prior to the war our cake consumption was approximately 1,310,000 tons a year, two-thirds of which were crushed at home. Germany's consumption was roughly 1,000,000 tons, all of which was crushed in Germany. England's blockade of Germany has consequently released for consumption elsewhere about 1,600,000 tons of oil seeds, chiefly copra, linseed, cotton seed, and palm kernels. With the increased live stock returns, we should expect our needs to amount to about 1,400,000 tons at a liberal estimate. There is sufficient raw material to produce 2,300,000 tons of cake. As we have seen, however, the crushing plant at our disposal at the outbreak of war was only capable of dealing with approximately one-third of this quantity. Consequently there is bound to be a shortage of cake until new crushing plants are laid down and in working order, in spite of the abundance of raw material. Such arrangements have to some extent already been made, various oil crushers having laid down new plant to deal with oil seeds of Colonial origin, so that considerable quantities of oil cakes, particularly palm kernel, will be available to the farmer for feeding stock this winter. The problem of the supply of concentrated feeding stuffs has, therefore, been partially solved, if the farmer will only show a little adaptability in the matter of feeding what to him are unfamiliar feeding stuffs. Of the cakes in question the supplies of linseed cake and cotton cake are likely to remain inadequate, but there will be a good supply of palm-nut kernel cake, coconut cake and, to a less extent, ground-nut cake available. A considerable amount of work has been done on the two first-named of these unfamiliar feeding stuffs, and enough experience has accumulated to warrant their adoption by the farmer, unaccustomed as he may be to handle them.

Palm-nut Kernel Cake.—Palm-nut kernel cake has been on the market for a considerable number of years, but has received little attention from the English farmer until recently, most of the cake produced in England being exported to

Germany, where it received a ready market at a price of £1 to £2 above the price of £5 5s. it commanded in England. Three months after the outbreak of the war, owing to the closure of the principal market, this cake was quoted at Liverpool at £4 17s. 6d. a ton, and the farmer who bought at this price made a very good bargain. At its present price, £7 10s. a ton, it is still an economical feeding stuff to buy. In Germany it has been used with excellent results for feeding dairy cattle, bullocks, sheep and pigs, and all German experiments have shown it to be an economical feeding stuff. At present its use is extending in Scotland and Ireland, and palm-nut kernel meal has given good results when fed to pigs. As far back as 1861, experiments at the Royal Agricultural College, Cirencester, established its value as a feeding stuff.

From bullock-feeding experiments conducted at the Norfolk Agricultural Station, for two months in the winter of 1914, the following conclusion was arrived at. Palm-nut kernel cake and linseed cake have approximately the same feeding value, since the difference observed between the two lots of bullocks fed was considerably smaller than the probable error of the experiment. Bruce, in bullock-feeding experiments undertaken at Spencerfield, for the Edinburgh and East of Scotland Agricultural College, at the same time came to the conclusion that palm-nut kernel cake is a useful feeding stuff, and is about equal in value to the best class of dried distillery grains. Cattle soon take to it, and there appears to be no practical difficulty in feeding it to fattening bullocks when they are accustomed to it from the beginning of the fattening period.

At the Midland Agricultural and Dairy College, this cake was fed to dairy cows, but was not readily eaten by them.

Several large dairy farmers near Glasgow have been using this cake with success. Where butter is made complaints are heard that the cake causes the butter to be of somewhat unpalatable flavour, but there seems to be no need for this to happen if the cake is judiciously used. In cattle-feeding experiments, conducted by the Glasgow and West of Scotland Agricultural College, the cake was found to be slightly superior to bran.

In an experiment carried out at the University College of North Wales, Bangor, in which palm-nut kernel was compared with Egyptian undecorticated cotton cake as a food for milking cows on grass, it was concluded that the results from the consumption of equal quantities of these two cakes were identical. Difficulty was at first experienced with the feeding,

but finally this was overcome. In experiments carried out by the Armstrong College at Offerton Hall, palm-nut kernel cake compared favourably with Bombay cotton cake.

Coconut Cake.—With regard to coconut cake, very little work has been done in this country, but on the Continent it is especially esteemed for feeding to dairy cows. Wakerley has compared it with linseed cake, and reached the conclusion that with linseed cake at over £9 a ton, coconut cake is worth feeding at £6 15s. Bruce, in a feeding experiment conducted in 1911-1912, came to the conclusion that with linseed cake at £10 10s., coconut cake is worth £7 a ton for bullock feeding. The use of coconut cake is extending in the Reading district. A serious charge levelled against both palm-nut kernel cake and coconut cake is their tendency rapidly to go rancid. In reference to this point, it is interesting to note that in an experiment conducted by Mackintosh, of Reading, coconut cake kept in splendid condition from April, 1914, to June, 1915. Provided that these cakes are carefully stored, and are kept in a cool dry place, there is little reason to fear rancidity. There is little doubt, however, that once these cakes get moist, rancidity rapidly sets in.

Ground-nut Cake.—Ground-nut cake is a new feeding stuff, rich in protein, possessing high digestibility coefficients. In the Reading district it is being freely offered, and occasionally purchased, but farmers differ in their opinions of it. The German experimenters have reported favourably of it, and it has proved of particular value for partial replacement of the oat ration of horses. The high protein content renders it especially liable to bacterial attack with the subsequent development of toxic bodies. Occasionally, too, the presence of castor-oil seeds leads to illness in the animals. The cake should, therefore, be fed with great caution, and samples showing the slightest signs of rancidity or bitterness should be instantly rejected.

Dried Yeast.—One other feeding stuff deserves mention. Dried yeast has for some little time been exported to Germany, and 2,000 to 3,000 tons are produced here annually. Dried yeast is very rich in albuminoids, and has been used successfully for all classes of stock. Formerly its use was attended with unfavourable results owing to technical difficulties in drying giving rise to a poor product; but these difficulties seem now to have been overcome. With a view to establishing its qualities as a feeding stuff, Professor Crowther has conducted an experiment both with cows and pigs. With cows, difficulties

of feeding arose owing to the bitter principle contained in the yeast, and its use seems to be unsuitable for this class of animal. The experiments with pigs, however, confirmed its suitability as a feeding stuff for this animal, and its safety was established. Owing to its high protein content, it forms a favourite constituent of patent foods, mixed with such unsuitable materials as peat moss, wood charcoal and hops. One such patent has recently been taken out for a mixture composed of peat moss, yeast, hops, and molasses. It is unnecessary to emphasise here the doubtful value of such proprietary feeding materials.

It is apparent from the above results of English feeding trials that the new feeding stuffs available for stock are capable of replacing the better known oil cakes, and the economical feeding of live stock is possible even should linseed cake and decorticated cotton cake reach prohibitive prices. There is, therefore, little danger in the immediate future of a shortage of concentrated feeding stuffs of a suitable nature for live stock of all descriptions.

GERMAN AGRICULTURE AND THE WAR.*

THE food supply of Germany has very naturally attracted much attention during the past 15 months. The translation of a popular German book explaining the facts as seen from the German point of view appeared on the bookstalls a few months ago;† the current number of the *Quarterly Review* contains a critical study of the question by an English economist,‡ and it is difficult to pick up a daily newspaper without finding some mention of the shortage in the German Empire of this or that article of food. The fact that—thanks to the efficiency of the British Navy—there is not a superabundance of food in Germany is known to everybody in this country who takes any interest in the progress of the war, but the steps which the German Government has taken to husband and increase its resources are not so generally understood.

The following account of the measures adopted in this matter by the German Government is based for the most

* It should be noted that the information contained in this article is from German sources.

† *Germany's Food; Can it Last?* English version, edited by S. Russell Wells, M.D., B.Sc. (University of London Press.)

‡ *Germany's Food Supply*, by Prof. W. S. Ashley. (*The Quarterly Review*, No. 445, October, 1915.)

part on a book,* which has been written by two of the collaborators in the work mentioned above, and it deals with action taken in regard to agriculture by the German Government during the first 10 months of the war, and also with the steps which it is considered should be taken during the continuance of the war. Where necessary, however, reference has been made to some of the numerous articles, which have appeared in the German agricultural papers, which have followed this all-important matter with the closest attention.

Before going further, however, it may be desirable to explain that in peace time the Imperial Government centred in Berlin had little or no executive power in matters appertaining to agriculture. The Prussian Government administered in Prussia its own laws relating to agriculture, the Bavarian Government did the same for Bavaria, and in a similar way each of the States, which make up the German Empire, had control in its own territory. With the outbreak of war, however, the Federal Council (Bundesrath) consisting of representatives from each State, was given full power to deal with all economic problems that arose out of the conduct of the war, and it is the Federal Council which is responsible for the food supply of the whole empire. The difficulties which would have arisen if contiguous States took different action in dealing with the same particular question of the food supply were in this way eliminated.

Up to about the year 1870 Germany grew more foodstuffs than were required for home consumption, but the development of her industrial resources resulted in an ever-growing competition between the factories and the farmers for supremacy. By the imposition of heavy import duties on foodstuffs, and in various other ways, the Government endeavoured to maintain a balance between the activities of the manufacturer and the work of the farmer. It was so far successful that at the outbreak of the war Germany was producing about nine-tenths of the food and fodder usually required. In other words, she imported, after allowing for exports, one-tenth of the food she required to feed her people and her livestock. When the war broke out, however, the harvest had not all been gathered in, and the military operations, especially those in East Prussia, caused considerable losses to standing crops, which, together with the resulting disorganisation of the railways and of labour, much enlarged the deficiency of one-tenth.

* *Unsere bisherige und unsere künftige Ernährung im Kriege.* By R. Kuczynski and N. Zuntz. (F. Vieweg und Sohn, Braunschweig, 1915.)

The position, however, was not so serious to Germany as would at first appear, since a large part of the food, such as barley, oats, potatoes, etc., consumed by live stock, would serve equally well for man. If, therefore, a sufficient number of animals were slaughtered, the foodstuffs which they would have consumed could be used in a large measure to cover the deficiency in human food. The obvious plan, therefore, was to reduce the number of animals in the country in just sufficient measure to make the required amount of human food available. The necessary steps to this end were not, however, taken early enough, and it is abundantly plain that the Government did not fully realise the position that had arisen. In passing, it may be observed that much has been written about the elaborate plans which the German Government had prepared in readiness for war, but, however effective may have been the administrative excellence of these plans as regards the army and the railways, it is clear that, as far as the organisation of the food supply of the country was concerned, little or nothing had been done. An interesting article on this subject, written before the war, was published as late as October, 1914.*

Returning to the action taken by the Government, with reference to the slaughter of animals. The year 1913 had brought an exceptionally good harvest, and, as a result of the ample supply of fodder available, the beginning of the war found the number of cattle in the country unusually high. The harvest of 1914 was not so good, and consequently, in normal peace times, lack of fodder would have caused a natural decrease in the number of animals.

The first result of the outbreak of war was to cause farmers in many parts of the country to offer their cattle for sale. This was a movement in the right direction, and would at once have eased the situation as regards food supplies. The Government, however, failed to recognise this, and the Federal Council issued an Order on the 11th September, 1914, forbidding the slaughter of calves under 165 lb. in weight, and of cows under 7 years old; the local governments were also empowered at their discretion to forbid the slaughter of swine. The result of this policy at the beginning of December, 1914, was an actual increase in the number of cattle and swine as compared with the period before the outbreak of war. In December and January, however, the number of swine diminished, and in the meantime also the Government had realised the growing seriousness of the position, and took

* *Die Lebensmittelversorgung unsere Städte für den Kriegsfall.* Zeitschrift für Agrarpolitik, October, 1914.

steps to encourage the slaughter of swine, so that by the middle of March the number had diminished by 29 per cent. There can be no doubt that the whole question was very badly mismanaged, and that if the decrease had been brought about at the very beginning of the war, much anxiety with regard not only to the food supply of the people, but also to that of valuable animals, would have been avoided.

The excessive number of pigs consuming immense quantities of corn, barley, oats, and potatoes undoubtedly led to the shortage of corn for bread which followed, and to the necessity of reducing the oats ration of even the army horses, to say nothing of farm and other horses which suffered severely by the shortage of oats. A large number of the pigs, which were fed at the cost of other more useful animals, and to the detriment of the ultimate well-being of the people, were only barely kept up to weight, and did not increase the supply of meat or lard, so that the foodstuffs they received were in fact a dead loss to the community.

Professor Ashley says: "It was reckoned by a competent authority before the war that the cessation of fodder imports would involve a decrease in the supply of meat to one-half."* That the decrease should be as much as one-half hardly follows from the information available,† but it is important to note that the ultimate effect of the necessary balancing between man and beast of the available food supplies is much more than the one-tenth loss, which the deficiency in fodder of that amount would at the first glance seem to indicate, and it is all the more surprising that the only solution of the question of how to make up the shortage in human food did not form part of the Government's policy from the very beginning of the war. If it had been decided in August, 1914, that the number of cattle and swine should be decreased by 30 per cent. within a certain limited time, most, if not all, of the difficulties with bread and potatoes, which are now to be discussed, would have been avoided.

The 1914 corn harvest was very satisfactory both as regards wheat and rye, the latter forming the staple bread of the German Empire.‡ About one-sixteenth only of the total normal consumption was not produced in the Empire, and since in ordinary times one-ninth of this total was used as fodder, there was ample corn available to allow of the same amount of bread being baked as in peace time. It was only

* *The Quarterly Review*. October, 1915, p. 446.

† But see also the same article, p. 460.

‡ About $\frac{7}{11}$ths of the bread normally consumed is rye bread and $\frac{4}{11}$ths wheat bread.

necessary to take stock of the position, and prevent the increased use of rye and wheat as fodder, in face of the temptation to do so, caused by the lack of imported barley, maize, oil cake, and other feeding stuffs. For three months, however, nothing was done, and it was only on the 4th November, 1914, that an Order was issued prohibiting the use of rye and wheat as fodder. By this time enormous quantities of corn had already been fed to stock, and on the 1st December only one-half of the product of the 1914 harvest was left; the other half and the stocks remaining from the previous year had already been consumed.

During December and January nothing further was done. The prohibition was certainly in force, but the temptation to avoid it was too strong, and during these three months more corn was fed to stock than in ordinary times without prohibition. The seriousness of the position was not realised in time by the Government, and when on the 25th January the Federal Council made it known that on the 1st February the whole stock would be requisitioned by the State it was too late to save the situation in any adequate measure, for on the 1st February only one-third of the 1914 harvest was left.* It cannot be denied that, after having perceived the danger at this late stage, the Government dealt with the question in a courageous manner. A ration per head was prescribed which amounted to only three-fifths of the normal consumption. In spite of the fact that the trade was now controlled by the Government, the price of flour was high, and there was much sharp criticism of the policy of the Government on this account.

The shortage of corn and the increasing cost of meat led to the increased consumption of other foods; the chief of these was the potato.

Germany produces more potatoes than any other country in the world, and the visible supply at the beginning of the war was sufficient to meet the ordinary needs of the people as regards food three times over. The greater part of the potatoes had been used in previous years for fodder and the manufacture of starch and alcohol, and it was only necessary to decrease to some extent the amount used for these purposes in order to provide the additional amount required for human food. During the first months of the war, however, the Government adopted a policy which led to the opposite result. Farmers were exhorted to feed

* For an account of the fixing of prices of corn previous to the requisitioning by the State, see *The Economic Journal*, June, 1915: *Maximum Corn Prices in Germany*, by Mrs. Stocks.

potatoes as much as possible to their stock, and, in addition, a maximum selling price was fixed as from the 28th November, 1914, this also having the effect of encouraging the feeding of stock with potatoes. When, however, the position as regards the low stocks of corn was realised, as described above, the policy hitherto adopted was altered. Warnings were issued calling attention to the necessity of eking out the supply of bread with potatoes, and on the 15th February the maximum selling price was increased considerably.

In the meantime an unusually large quantity of potatoes was being consumed, both as a substitute for bread and as fodder. The Government was called upon to take action, and, in consequence, caused a stock-taking to be made, which later on was found to be very inaccurate, and which showed that the supplies apparently available were unexpectedly small. They came to the decision not to requisition the stocks of potatoes, but to purchase a large quantity with the assistance of the local authorities, who had to buy from the farmers at the maximum price already fixed. Only a small proportion of the amount required, however, was forthcoming; farmers preferred to hold back their stocks in the hope of a higher maximum selling price, or they had already entered into contracts with dealers.

A special Government Department, with considerable powers, and acting in conjunction with the local authorities, was then formed for dealing with the potato question. It was not possible even then to obtain the quantity of potatoes required. Subsequently, however, it appeared that considerable speculation in potatoes had been taking place, and, as a result of what was almost a panic, large stocks which had been held by dealers appeared on the market, with the result that prices fell rapidly. The Government Potato Department was also left with large stocks in hand, and lost a considerable sum of money as a consequence. Had the Government requisitioned the stocks early in the year much speculation would have been avoided, and a period of exceptionally high prices followed by a slump would not have occurred. Steps were taken to make the surplus potatoes available as far as possible for the potato-drying factories, which are now numerous in the German Empire. They produce in large quantities a dried potato flake which has good keeping qualities, and which consequently affords an excellent method for preventing any possible waste in this foodstuff.

From what has been said it will be perceived that the action taken during the first months of the war was not satisfactory. This is to be explained partly by the lack of any definite plan of action, and partly by the disorganisation in the administrative departments following mobilisation, which would lead to irregularity in the receipt of reports from agricultural districts. It must not, however, be supposed that the history of the first year of the war reveals nothing but incompetence on the part of those responsible for the administration of the agricultural resources of the German Empire. On the contrary, there are evident signs that once the seriousness of the position had been realised the various problems arising were adequately considered, and if the solution demanded bold action or the revision of some existing policy there was no holding back by reason of timidity or on account of consideration of political scruples.* It is true that the method adopted of dealing with the potato problem resulted in a fiasco, but it was due rather to the non-patriotic action of gamblers who had much concern for their own pockets and little for the common welfare, than to the inefficiency of the administration. In the present conflict with Germany Great Britain can expect little help from blunders which may be made by that country's agricultural experts. It is evident that every effort is being made to learn from the mistakes which have been made, and, during the next year of war, to make the agricultural resources of the country yield the greatest possible food value.

In the first place, the lesson of the balance between man and animal in the consumption of foodstuffs has been well learnt, and if a German family is to be limited to a maximum of three or four meat dinners a week, it will not be short of bread and potatoes. Meat supplies will be kept up as far as possible by feeding pigs on anything that a pig will eat, but which will not nourish a man. The woods will be used to the full in feeding swine, and cattle will have to eke out their fodder with acacia, horse chestnut, and other leaves.

The harvest now gathered† was not expected to equal that of the immediately preceding years. This was partly due to the expected shortage of labour, and the lack of draught animals, but chiefly to the scarcity of nitrogenous and phosphatic artificial manures. The former class of manures

* See *Zeitschrift für Agrarpolitik*, July, 1915. Bericht der Reichstags-Kommission über die Ernährungsfrage im Kriege.

† The information available points to a considerable decrease in the production as compared with 1914.

is represented by nitrate of soda, of which half a million tons are used annually by Germany for this purpose, and which is now naturally not available; and the latter, by imported phosphates and home-produced basic slag, which, in consequence of decreased iron manufacture, will be scarce.* In particular the sugar-beet crop will be considerably less than in the previous year, and it appears to be unlikely that there will be a surplus that can be fed to animals. The area planted was 30 per cent. less than in the previous year, and if the crop is a poor one, as appears probable, there will be danger of a shortage. It is clear that some time must elapse before Germany will be in a position to resume her export of sugar.

It was stated above that, although the feeding of corn to pigs was prohibited, many farmers fed it in spite of the prohibition. To prevent this occurring again, it is suggested that a maximum selling price for animals should be introduced, so arranged in accordance with the maximum price of corn, meal, and potatoes, that it will be no less profitable to sell these commodities than to feed the animals with them.

The following is a summary of the measures which are recommended by Messrs. Kuczynski and Zuntz in respect of the year following the 1915 harvest† :—

(1) The export of all foods to be stopped, and the import of foods to be encouraged.

(2) The new harvest of rye, wheat, and oats to be requisitioned. Belated action in the first half-year of war led to scarcity in the second half-year, and in the new harvest year there will be smaller stocks, and a smaller harvest. The requisition, therefore, must be more stringent so as to allow the population of the towns more bread, and horse keepers more oats.

(3) The prohibition of the feeding of rye and wheat to animals to be maintained.

(4) Some oats to be allowed to calves and lambs after the requisition has taken place, and horse rations have been fixed.

(5) The maximum prices for rye and wheat to be retained, and only to be raised if the yield is below the ten-year average.

(6) The maximum prices for barley and oats to be raised at least to the level of those for rye.

* *Germany's Food; Can it Last?* p. 17 *et seq.*
† Loc. cit., p. 70 *et seq.*

(7) The regulations as to milling rye and wheat to be maintained at least during the first half of the new harvest year.

(8) The measures relating to meal mixtures and bread-making to be simplified. The preparation of wheat bread from pure wheat might be permitted, but the addition of potatoes to rye should be maintained, though the use of potato flakes and meals should be forbidden until the spring.

(9) The meal ration for the population of towns to be raised from 250 grammes to 300 grammes per head per day, according to the results of the harvest.

(10) Greater quantities of potatoes should be dried, and the dried potatoes should not enter into consumption until the spring. Large quantities of fresh potatoes should be used just after harvest for pig feeding. The Government Potato Department should arrange for the supply of the needs of the population of the towns, which should be at least 1 lb. per head per day. It should also arrange for the supply of the necessary amounts to the drying factories, which should not release their stocks until the 1st March; and it should arrange how much can be fed to animals.

(11) Maximum prices for potatoes should be fixed according to harvest results, allowing moderately increasing extra payments for storage if the potatoes are taken from farmers after the 15th April.

(12) Maximum prices for pigs should be fixed so as to harmonise with the maximum prices for feeding stuffs. If, then, it proves impossible to get a sufficient supply of pork, a real expropriation should be carried out.

(13) Trade prices as well as producers' prices should be fixed so as to give consumers the benefit.

(14) Stronger measures to prevent damage to the harvest by game, etc., should be taken. Money compensation has the disadvantage that the whole community suffers from the smaller harvest.

(15) Feeding stuffs available in trees and in woods should be used.

(16) More efficient statistics of yields and of stocks should be taken.

(17) Censuses of animals should be taken on the 1st August, 1st December, and 1st April, and pigs in addition on 1st

October, 1st February, and 1st June, distinguishing the different classes.

The reasons for the growing scarcity of wool do not come within the scope of this article, but the question of fat is one that may be touched upon. Before the war large quantities of fat for margarine making and other purposes were imported. and the lack of this import, together with the lessened supply of fats produced in the Empire is undoubtedly causing considerable inconvenience. In this connection it is interesting to note that, as late as the 9th October last, the Federal Council issued an Order prohibiting the use of pure animal and vegetable oils and fats for industrial purposes, such as the oiling of machinery.* The oils used for such purposes must not contain more than 25 per cent. of animal or vegetable oils and fats.

THE FEEDING AND MANURIAL VALUES OF SUGAR BEET CROWNS AND LEAVES.

A COMMISSION of Dutch experts has recently concluded an enquiry into the feeding and manurial values of sugar beet crowns and leaves, and the results of their labours have been published by the Dutch Ministry of Agriculture, etc. (*Verslagen en Mededeelingen*, 1915, No. 4.) The enquiry related principally to conditions in the Dutch province of Zeeland, but in view of the interest of the subject to English sugar beet growers an account of the committee's findings may be given; it must be understood throughout that the recommendations are those of the Dutch Commission and not of the Board

Yield.—In some trials in Groningen, in 1906-7, an average yield of 25,000 lb. of sugar beet crowns and leaves per acre was obtained; in the province of Zeeland the yield of crowns and leaves has varied between 18,000 lb. and 36,000 lb., with an average of 24,000 lb., containing 80·9 per cent. of water and 4·5 per cent. of dirt.†

* *Zeitschrift der Spiritusindustrie*, 14th October, 1915.

† It must be noted that these yields, quoted by the Dutch Commission, are far in excess of those usually stated. Actual weighings and estimates in England give about 3 tons per acre as the figure.

Ten analyses were carried out in Zeeland in 1911 and 1912 of crowns and leaves that had lain for from 2 to 14 days on the land, and the following figures were obtained :—

	Average.	Minimum.	Maximum.
Crude Protein	2·37	1·5	3·8
Pure Protein	1·83	1·1	3·1
Digestible Protein	0·92	0·7	1·7
Sugar	2·81	0·8	4·9
Carbohydrates	5·43	3·8	8·7
Crude Fat	0·40	0·3	0·7
Crude Fibre	3·05	1·9	5·2
Ash	5·41	1·5	9·5
Dirt	3·57	0·2	6·9
Moisture	80·51	73·0	87·9

On the basis of these Zeeland figures, and taking Weiser and Tangl's digestibility coefficients,* crowns and leaves would average as follows, as fed fresh in practice: 19·5 per cent. dry matter (of which 3·6 per cent. is dirt), 1·1 per cent. digestible protein, 7·3 per cent. digestible carbohydrates, 2·3 per cent. digestible fibre, 0·1 per cent. digestible fat, and starch equivalent 9·1.

With 1·1 per cent. digestible protein and 9·1 starch value, 100 lb. crowns and leaves would be equal in feeding value to 100 lb. roots, 2·1 lb. cotton-seed meal and ½ lb. maize meal (the dry matter in roots is reckoned at 13·5 per cent.) *e.g.* :—

	Dig. Protein.	Starch Value.
	lb.	lb.
100 lb. roots	0·2	7·2
2·1 „ cotton-seed meal	0·83	1·51
0·5 „ maize meal	0·04	0·40
	1·07	9·11

Reckoning the prices per 100 lb. of roots at 6*d.*, of 100 lb. cotton-seed meal at 8*s.* and of 100 lb. maize meal at 5*s.* 10*d.*, the Commission estimate that the crowns and leaves would be worth 8½*d.* per 100 lb. or, say, 16*s.* per ton. The Commission arrive at a somewhat lower value for crowns and leaves by comparing them with pulp and cotton-seed meal; 100 lb. crowns and leaves would have the same feeding value as 120 lb. pulp and 2 lb. cotton-seed meal, thus :—

* Weiser and Tangl carried out digestibility experiments with sheep and obtained the following digestibility coefficients: Crude protein, 73·9; pure protein, 62·5; carbohydrates, 89·0; crude fat, 21·9; crude fibre, 74·8; total dry matter, 75·0 per cent.

	Dig. Protein.	Starch Value.
	lb.	lb.
120 lb. pulp	0·36	7·8
2 ,, cotton-seed meal	0·79	1·44
	1·15	9·24

Reckoning in all losses that occur until the pulp is fed, 100 lb. are priced at $4\frac{1}{2}d.$ so that the value of crowns and leaves would be *7d.* per 100 lb. or, say, 13*s.* per ton. Taking the average of these two price estimates the value of crowns and leaves would be 14*s.* 6*d.* per ton. On the basis of the Zeeland yield of 24,000 lb. per acre, the value of the crowns and leaves per acre would be £6 15*s.* (reckoning a loss of 15 per cent. before feeding).*

It is acknowledged by continental farmers that the crowns and leaves have a higher feeding value than roots, both milch and fattening animals being known to go back in condition when crowns and leaves are replaced by an even greater quantity of roots. Further testimony to the excellent feeding value of crowns and leaves is seen in the fact that at the time of the sugar beet harvest in Holland milch cows give a great deal of milk with a high fat content and at the same time maintain very good condition; and a very favourable effect is also noticeable in the case of fattening cattle.

The Feeding of Fresh Crowns and Leaves.—There is no doubt that the feeding of this by-product as green fodder is the most profitable method of use. It is the least costly method, the digestibility is the greatest, the loss by fermentation and rotting is unimportant, and at the time of the sugar beet harvest green fodder is getting scarce. Cattle can be (1) driven on the arable land after beet harvest, or (2) the crowns and leaves can be collected and placed on the grass land either in heaps or spread out over the land, or, lastly (3) the cattle can be stall fed with the crowns and leaves with the addition of concentrated foods and straw.

The first is the most usual method in Zeeland, dairy cattle, fattening cattle and young cattle above one year, and to a less extent horses, sheep and even calves, being driven on the beet fields immediately after harvest and kept there until the middle of November as a rule, but in some cases till the middle of December or even later, much, of course, depending on the weather. The great advantage of this method is that very

* The value of crowns and leaves per acre in England, on the basis of a yield of 3 tons, is usually placed at about 20*s.* per acre.

little labour is necessary for the care of the animals. On the other hand, the arable land may suffer from the trampling of animals, especially in wet weather; on light, porous lands the damage caused is not so great. The trampling of the animals on the crowns and leaves may also lead to much loss of the latter (from 30 to 50 per cent.), but, with dry weather and the employment of animal attendants to ensure that the animals eat off one part of the field at a time, this loss, it seems, may be much reduced (viz., to from 10 to 15 per cent.). Finally, the health of animals may suffer in bad weather, and if the animals are not housed during the night, owing, it is believed, to the dirty condition of the animals, the wet situation, the consumption of large quantities of dirt and the occurrence of diarrhœa. Housing the animals during the night, feeding the crowns and leaves in clean condition, and supplementing with hay, straw and concentrated foods, seem very effective preventive measures.

Some Zeeland farmers always feed the crowns and leaves to animals on grass, while others only do this in wet weather; by this method less fodder is lost and arable land does not suffer so much by trampling in wet weather. To prevent loss, not too much must be allowed the animals at one time, and the crowns and leaves should be spread out over the land as much as possible; there will thus be less trampling of fodder, and the cows will be quieter as they will not herd together. Distribution of the fodder all over the field will ensure, in addition, even manuring. The chief disadvantage of this method of use is that it is costly in labour, both of men and horses. It may also impair, unduly, the fertility of the arable land. Housing at night and supplementary feeding with dry food are desirable at the end of autumn and in bad weather.

Stall feeding is not common in Zeeland, but excellent results are obtained in the Wilhelmina polder where the supplementary foods are straw and meat meal. One Zeeland farmer has successfully fed cows in this way for several years. The animals are stalled at the beginning of beet harvest, and one man with horse and cart is able to carry out the feeding of 20 animals.

On the basis of the requisite amounts of dry matter, digestible protein and starch equivalent laid down by Kellner, the Commission recommend the following rations*: For *fattening*

* These quantities of crowns and leaves recommended by the Dutch Commission are very large compared with those recommended by German authorities.

cattle of 1,000 lb. live weight—120 lb. crowns and leaves, 4 lb. meadow hay, 6 lb. oat straw and 2 lb. cotton-seed meal ; *for young growing cattle* of 800 lb.—80 lb. crowns and leaves, 2 lb. meadow hay, 6 lb. oat straw and 1 lb. cotton-seed meal ; *for milch cows* with a live weight of 1,200 lb. and a milk yield of 24 lb.—80 lb. crowns and leaves, 8 lb. meadow hay, 1 lb. wheat chaff, 1 lb. oat chaff and 2 lb. ground-nut cake ; *for pigs* at beginning of fattening per 100 lb. live weight—14 lb. crowns and leaves, 0·7 lb. pea meal, 1 lb. maize meal, 1 lb. barley meal.

Results of Feeding of Crowns and Leaves.—Excessive feeding of crowns and leaves has, in some instances, been harmful to the health of animals, diarrhœa, symptoms of poisoning and bone-weakness having been observed.

Diarrhœa is in all probability not to be ascribed to the dirt adhering to the crowns and leaves ; and Müller and Wendt, who investigated the question, concluded that it did not result from the oxalic acid present, but from bacterial infection of dirty leaves, the risk of diarrhœa being diminished the drier and the cleaner the leaves.

As regards poisoning following the consumption of large quantities of crowns and leaves, the cause was ascribed, in a case which occurred in the present year, and which was investigated by a Hanover veterinary surgeon, to the oxalic acid ; the content of oxalic acid is known to increase in dry weather.

Finally, bone-weakness has been noticed with long continued feeding and especially when the crowns and leaves have turned sour.

The following measures are recommended by the Commission :—

(1) Care should be exercised as to feeding crowns and leaves harvested in the early morning dew, or in wet weather ; diarrhœa is much less liable to result with crowns and leaves harvested dry.

(2) Where circumstances permit, the beets should be cleared off in the middle of the day and the leaves not left on the land longer than is absolutely necessary. On smaller farms, where labour is available, crowns and leaves should be spread out in thin layers on grass and clover land.

(3) The crowns and leaves should be fed with care when a very dry summer and autumn have been experienced, on account of the risk of poisoning. If the ration of crowns and

leaves were gradually increased, harmful effects could be observed before they had a fatal outcome.

(4) Supplementary feeding with straw and hay is very desirable.

(5) The addition of chalk to the ration is not desirable; it increases the diarrhœa, especially when the leaves are dirty.

(6) A small quantity of phosphate of lime should be fed every day; from $\frac{7}{10}$ oz. to $1\frac{1}{2}$ oz. is sufficient for dairy cows, larger quantities having an unfavourable effect on the milk products.

Practical farmers in Holland are agreed that, when milk cows go from the scanty pasture to feeding with crowns and leaves, both the yield and fat content of the milk increase. The following figures relate to a small dairy, the supplying farmers being all beet growers :—

Period.	Milk delivered per day (kg.).	Fat average percentage.
September 17th to 30th... ...	1,540	3·22
October 1st to 14th	1,580	3·30
„ 15th to 28th	1,880	3·37
„ 29th to November 11th	1,980	3·41
November 12th to „ 25th	1,980	3·37
„ 26th to December 9th	1,870	3·28

The beet harvest commenced at the beginning of October and from 15th to 28th October all cows received crowns and leaves, this fodder taking a smaller place in the ration from the latter half of November.

In the case of another dairy, particulars were obtained as to 12 farmers who fed crowns and leaves in large quantities. The feeding began in October; the average fat percentages for the milk of the whole 12 farmers were: In July 3·09 per cent., in August 3·12 per cent., in September 3·19 per cent., in October 3·38 per cent., in November 3·49 per cent., and in December 3·38 per cent. The average fat content of the milk of 88 cows in Zeeland control unions was 3·39 per cent. previous to feeding with beet leaves in 1914, and 3·56 per cent. three weeks later when all cows were on leaves. The same fact was elicited by enquiries addressed to individual farmers, the increase being said to be not so noticeable with pastures in good condition, or with animals longer than six months in milk.

The butter is firm, granular, and churned with difficulty, and the taste is inferior; these defects could be remedied by

reducing the quantity of this fodder in the rations and using such supplementary foods as give a soft butter fat.

Further, in many cases the milk does not seem to be very well suited to human consumption as it has an unpleasant smell and taste and has been known to cause diarrhœa in children. The cause is bacterial infection of the milk combined with chemical changes in the fat, the bacteria on the leaves reaching the milk either directly through particles of the fodder falling in the milk pail, or, indirectly, *i.e.*, by way of the manure. It is very difficult to obtain clean milk during the feeding, diarrhœa and the dirt in the food leading to a dirty condition of the cows.

Smell, taste, and cleanliness are very favourably influenced by:

(1) Care in feeding undamaged crowns and leaves.

(2) Limiting the amount of crowns and leaves fed and supplementing them with other foods, such as meadow and clover hay, bran, linseed meal, ground-nut cake and rice meal.

(3) Keeping the cows as clean as possible.

(4) Milking in places where the air is not contaminated by rotting leaves, and cleaning the stall and fodder troughs well and often.

The Separate Use of Crowns.—It has been stated above that sugar beet crowns and leaves are best used fresh. Where the head of stock kept is not sufficiently large, and for other reasons, this method may not be possible throughout.

The first method possible in such cases is the removal of the crown with only a small part of the leaf stems adhering. On the average of 8 investigations in Zeeland, yields of 38,933 lb. of beets, 6,036 lb. of crowns, and 18,828 lb. of leaves per acre were obtained; thus crowns formed one quarter of the total weight of crowns and leaves. In harvesting, the leaves are cut off first, then the crowns, the latter being placed in small heaps and subsequently collected in sacks and brought to the farmstead; the disadvantage of this method is that, in working quickly, too large an amount of crown may be cut off, and the alternative is separation of crowns from leaves after removal of the beets. The crowns are stored in heaps about 3 ft. wide and $1\frac{1}{2}$ ft. to $2\frac{1}{4}$ ft. high, the heaps being turned over at least once every month; covering with straw, etc., is necessary as a protection from frost.

The sugar content of the crowns is from 3 to 6 per cent. lower than that of beets, but the content of nitrogenous

substances is about twice as great. There are no analyses in the text books of crowns with part of the leaf stems adhering, such as occurs in practice, so that special analyses were carried out of crowns as harvested in Zeeland. Combined with Tangl and Weiser's digestibility figures, these show the following average results: dry matter, 23·4 per cent. (of which 2·33 per cent. is dirt), digestible protein 1·1 per cent., digestible fat 0·1 per cent., digestible carbohydrates 12·7 per cent., digestible fibre 2 per cent., starch equivalent 12·7.

On the basis of these figures 100 lb. crowns would have the feeding value of 80 lb. roots, and 11 lb. barley meal; or of 100 lb. pulp, and 21 lb. hay. The following rations are recommended by the Dutch Commission: *milk cows* of 1,200 lb. live weight, and 24 lb. milk yield, 46 lb. crowns, 10 lb. meadow hay, 1 lb. wheat chaff, 1 lb. oat chaff, 3 lb. ground-nut cake, 40 lb. roots; *fattening animals* of 1,000 lb. at beginning of fattening period, 64 lb. crowns, 2 lb. meadow hay, 2 lb. cut aftermath, 2 lb. cut pea straw, 1 lb. wheat chaff, 1 lb. oat chaff, 1 lb. meat meal, 1 lb. linseed meal, and 20 lb. roots; *young growing cattle* of 800 lb. live weight, 44 lb. crowns, 2 lb. meadow hay, 2 lb. cut aftermath, 2 lb. cut pea straw, ½ lb. wheat chaff, ½ lb. oat chaff, 1 lb. meat meal, and 20 lb. roots; *pigs* at beginning of fattening, per 100 lb. live weight, 10 lb. crowns, 0·3 lb. linseed meal, 0·4 lb. pea meal, 1 lb. maize meal, and 1 lb. barley meal; *draught horses*, at moderate work per 1,500 lb. live weight, 30 lb. crowns, 12 lb. meadow hay, 8 lb. pea straw, and 10 lb. oats. For cattle and sheep roots may be replaced by pulp, 100 lb. mangolds being equal to 110 lb. fresh pulp, or 14 lb. dry pulp.

Crowns appear to be a good food for sheep, horses, and pigs.

Silage from Crowns and Leaves.—The second method possible where the crowns and leaves cannot all be fed fresh is to convert the fodder into silage. In ensiling loss occurs (*a*) of weight, (*b*) of nutrients, (*c*) of digestibility. (*a*) With careful management, 100 lb. fresh tops and leaves will give 67½ lb. of silage fit for feeding. (*b*) The following are the average increases (+) or decreases (—) found in four tests in Zeeland and by Tangl and Weiser (reckoned as percentages on fresh constituents): crude protein — 3·90 per cent., pure protein + 7·90 per cent., digestible protein — 37·40 per cent., sugar — 94·80 per cent., carbohydrates + 43 per cent., crude fat + 11·80 per cent., crude fibre + 3·60 per cent., ash + 64 per cent., dirt + 86 per cent., water — 3·40 per

cent. (*c*) The results of Tangl and Weiser's investigations are as follows (percentage digestible, fresh given first, silage second): organic substances 82·5, 60·3; crude protein 73·9, 46·0; pure protein 62·5, 34·9; crude fibre 74·8, 52·2; carbohydrates 89·0, 72·8.

Reckoning a loss of 29·5 per cent. in ensiling, and that a further 3 per cent. will not be fit for feeding, the yield of silage will be about 16,262 lb. per acre. From the foregoing data this may be expected to contain 22·2 per cent. dry matter, 6·6 per cent. dirt, 0·7 per cent. digestible protein, 5·8 per cent. digestible carbohydrates, 1·6 per cent. digestible fibre, and a starch equivalent of 7·3 per cent. Thus 100 lb. of silage would be equal in feeding value to 90 lb. roots and 1·3 lb. cotton-seed meal; or to 50 lb. pulp, 10 lb. hay and 1½ lb. barley meal.

The Dutch Commission recommend the following rations: *fattening cattle* of 1,150 lb. live weight, 32 lb. silage, 4 lb. meadow hay, 1 lb. cut aftermath hay, 2 lb. cut pea straw, ½ lb. wheat chaff, ½ lb. oat chaff, 2 lb. ground nut cake, 6 lb. second quality wheat, and 30 lb. roots; *young growing cattle* of 800 lb. live weight, 32 lb. silage, 6 lb. meadow hay, 4 lb. cut oat straw, 3 lb. cut pea straw, 2 lb. cotton-seed meal, 20 lb. pulp, and 30 lb. roots; *dairy cows* of 1,200 lb. live weight, and milk yield of 24 lb., 50 lb. silage, 10 lb. meadow hay, 1 lb. wheat chaff, 1 lb. oat chaff, 2 lb. linseed meal, 3 lb. ground-nut cake, 40 lb. roots; *pigs* at beginning of fattening period, per 100 lb. live weight, 12 lb. silage, 0·3 lb. linseed meal, 0·8 lb. pea meal, 0·8 lb. maize meal, and 1 lb. barley meal.

Drying of Crowns and Leaves.—The third method of using surplus crowns and leaves is by drying. Methods of drying were commenced in Germany on account of the large loss in ensiling. On small farms in favourable weather drying in the open may be resorted to, but most of the drying is done in the special apparatus which has been erected in various parts of Germany, there being four different methods in use. No loss of digestibility, except of protein, seems to occur on drying. Experiments with dried crowns and leaves show that the fodder has a feeding value somewhat less than that of good meadow hay.

The special conditions obtaining in the Netherlands are thought to preclude any great extension of artificial drying in that country. The best method of using the crowns and leaves is, therefore, stated to be as follows:—

At the beginning of the beet harvest some of the cattle are stalled, the rest of the animals being left to depasture the fields; thereafter all cattle are stalled. Leaves and crowns will form the principal food, being supplemented with a little hay or straw or some concentrated food. Feeding with fresh leaves and crowns will be continued until a fortnight or three weeks after the end of beet harvest. If the amount of crowns harvested is so large that they are stored in heaps, a ration consisting principally of beet crowns can be fed till the end of January. Finally, where crowns and leaves have been ensiled or dried, they may form a considerable part of the ration from the end of January onwards.

Manurial Value of Crowns and Leaves.—It is well known to beet growers that the ploughing under of crowns and leaves is attended with good results for the following crop. German estimates of the manurial value vary between 12s. and 20s. per acre. At Lauchstadt the crowns and leaves from 1 acre were found to contain 119 lb. nitrogen, 41 lb. phosphoric acid, and 152 lb. potash. These figures were higher than those obtained in Zeeland on the basis of Zeeland analyses and Zeeland yields, viz., 92 lb. nitrogen, 28 lb. phosphoric acid, and 125 lb. potash per acre. The leaves of the sugar beet contain, per acre, larger quantities of plant nutrients than are found in the leaves of other "roots."

At Lauchstadt oats were grown on plots on which the crowns and leaves had, and had not, been ploughed in; the increase resulting from the crowns and leaves was 856 lb. grain, and 674 lb. straw per acre. Experiments with potatoes were carried out in Holland in 1912 and 1913 to test the point. In the first, the ploughing under of the crowns and leaves produced a total increase of 1,000 lb. where artificials were used, and of 1,017 lb. where no artificials were used, on the two sets of plots; the percentage of larger-sized potatoes was greater on the plots manured with crowns and leaves. In the second experiment the increased yields were 480 lb. (artificials on both sets of plots), and 1,856 lb. (no artificials) respectively, the percentage of large tubers again being greater. In the third experiment leaves and crowns were separately tested, leaves being applied at the rate of 26,200 lb., and crowns at the rate of 22,600 lb. per acre (or, respectively, two and three times the actual yield); the total yields of potatoes per acre were:—Unmanured 22,272 lb.; leaves, 24,014 lb.; crowns, 25,221 lb. The manuring and yields in the fourth experiment were as follows, per acre:

unmanured, 17,236 lb.; leaves and crowns (17,007 lb. per acre), 18,180 lb.; leaves alone (11,368 lb. per acre), 18,308 lb.; leaves and crowns (17,007 lb.) and ammonium phosphate (647 lb.), 23,369 lb.; ammonium phosphate alone (647 lb. per acre), 22,483 lb.

In view of the present difficulty of obtaining artificial potash manures, the desirability of growing potatoes after sugar beet, where practicable, might well be considered.

DEMONSTRATIONS OF MOTOR PLOUGHS AND TRACTORS.

As a result of suggestions made by the Board of Agriculture and Fisheries, demonstrations of labour-saving machinery have recently been carried out by the County Councils of Lincoln (Lindsey), Essex, and Northants, the Suffolk Agricultural Association in conjunction with the East Suffolk County Council, and the University of Cambridge. (Since the date of writing, another demonstration has been held in Yorkshire under the auspices of the Yorkshire Agricultural Society and the Yorkshire Council for Agricultural Education.)

Although such labour-saving devices as potato diggers, dung spreaders, a turnip-topping and tailing machine, a turnip thinner and horse hoe, a root cleaner and cutter, a hedge cutter for horse power, a pig-feeding machine, milking machines, and model silos were exhibited, the demonstrations had regard chiefly to motor ploughs and tractors.

From the point of view of the attendance and interest aroused on the part of farmers, the demonstrations were all extremely successful; thus, it is estimated that over 1,000 people were present at each of the two demonstrations in Lincolnshire, and at Chelmsford the attendance numbered some 400 to 500, including members of the Departmental Committee on the Home Production of Food. Several hundreds were also present at the other demonstrations.

The conditions under which the trials of motor ploughs and tractors took place were, perhaps, too favourable for definite conclusions to be formed as to the general usefulness of the various machines. The weather was fine in all cases, and the land generally dry; the soils were, as a rule, light, but in the Cambridge demonstration the soil was a heavy loam, in places changing to a heavy clay, and in others to a lighter loam. It must, of course, be remembered, on the other hand, that wet weather need not seriously interfere with the employment

of motor ploughs and tractors, since the work may be done sufficiently quickly to be accomplished in spells of fine weather. It is probable that the motor ploughs and the lighter tractors will usually be workable under the same weather conditions as horse-drawn ploughs. The soil in the Cambridge demonstration was so hard that it was doubtful whether horse ploughs would have worked successfully. Cross ploughing, and the ploughing in of dung, were not tested in these demonstrations.

The number of machines tested was affected by the difficulty experienced by manufacturers in supplying machines and men, and by difficulties of transit. In some cases the railway companies were able to afford special facilities for delivery.

The prices of the motor ploughs (combining plough and motor in one) tested are lower than those of the tractors (*i.e.*, without ploughs); the motor plough would probably be most suitable where the ploughing can be spread over several months. On the other hand, the tractor is favoured where large areas have to be ploughed quickly, and where there is much haulage and threshing to be done.

Various particulars as to the motor ploughs and tractors tested are given in the table on p. 762.

Demonstrations of the *Fowler-Wyles Motor Plough* were given at Frithville (Lincolnshire), and Bramford (East Suffolk), at both of which places it did good work. The motor drives two spiked wheels, and is very simply controlled with one lever by a man sitting at the rear; the plough may be used for either single or double-furrow work. Its small size (3 ft. high by 2 ft. 4 in. wide) allows of its employment in hop gardens and orchards where horses are less suitable. It seems to be capable of ploughing about 3 acres per day. Various kinds of farm work other than ploughing, *e.g.*, cultivating, are possible. When not in use in the fields the engine may be used for grinding, chaff cutting, etc.

The *Wyles Motor Plough* is similar in type to the foregoing, and is adapted for the same kinds of field work. It is, however, fitted with a more powerful engine. It did very good work at Chelmsford. A suitable pulley is attached for belt driving.

Martin's Motor Plough was exhibited at Frithville, Appleby (Lincolnshire), Cambridge, and Bramford, and did good work. The feature of this machine is that it obtains its motion from an endless chain or "creeper" 6 in. wide, giving a 3-ft. continuous tread. There is a creeper on each side, and the one

Name.	Manufacturers.	H.P. (b.p. at drawbar in brackets).	Weight.	Fuel.	Plough.	Price.
			T. c.			£
Motor Ploughs.						
"Fowler-Wyles" Plough ...	John Fowler & Co. (Leeds), Ltd. ...	8—9	16	Petrol or benzol	2 furrow ...	158
Wyles Motor Plough	Wyles Motor Ploughs, Ltd., Manchester.	11—12	1 2	,, ,,	2 ,, ...	172
Martin's Motor Plough ...	Martin's Cultivator Co., Stamford ...	15—16	—	Petrol	2 ,, ...	200
Crawley's Motor Plough ...	Crawley Bros., Hadstock	30	1 10	,, ...	3 ,, ...	—
Tractors.						
Wecks-Dungey "Simplex"...	Wecks & Son, Ltd., Maidstone ...	22½	1 5	,, ...	2-3 ,, ...	210
"Big Bull" or "John Bull"	(Agents) Cyrus Robinson & Co., 61, Holland Road, London, W.	20 [7]	2 0	,, ...	3 ,, ...	230
"Mogul"	International Harvester Co., London	25	4 5	Paraffin or petrol	3-5 ,, ...	400
"Daimler"	Daimler Co., Ltd., Coventry ...	40	4 10	Petrol	4 ,, ...	600
Saunderson's "Universal" Model "G."	Saunderson & Mills, Ltd., Bedford...	20 brake	2 15	Mineral spirit or paraffin.	3-4 ,, ...	325
"Sandusky"	(Agents) Mills & Son, Ltd., Paddington.	40—45 [15]	3 10	Petrol	4 ,, ...	578
"Overtime"	Overtime Farm Traction Co., London	24 [12]	2 3	Paraffin ...	3 ,, ...	231
"Ivel"	The Ivel Agricultural Motors, Ltd., Biggleswade.	24	1 17	,, ...	3 ,, ...	265
Mann's Steam Tractor ...	Mann's Patent Steam Cart and Wagon Co., Ltd., Leeds.	—	4 10	Coal or coke ...	4 ,, ...	—
Ransome's Steam Tractor ...	Ransome, Sims & Jeffries, Ipswich	—	4 15	,, ...	4 ,, ...	—

in the furrow has a tendency to break up the soil rather than solidify it. The creeper device worked well on dry, light land, and when the plough was replaced by a cultivator the engine drew this readily through the freshly-ploughed ground without injury to the soil. At Appleby, although some time was occupied in examination and enquiries, it ploughed 1½ acres in 4 hours (double furrow).

Each of the foregoing machines is easily worked by one man; the consumption of petrol per acre varies from about 1½ gal. to 2½ gal. They can turn readily on a 4-yd. to 5-yd. headland, and appear to be better adapted than tractors for small fields, hilly land, and land on the ridge system.

Crawley's Motor Plough, also self-contained, and manipulated by one man, did excellently at Chelmsford, and attracted much attention at Cambridge, where it worked powerfully, and drew a 3-furrow plough on all the classes of soil at considerable speed. It has evidently plenty of power, and is capable of ploughing the heaviest classes of soil satisfactorily. It seems easy to control, and requires a narrow headland.

The Weeks-Dungey "Simplex" Tractor.—This is a compact machine, measuring 7 ft. 4 in. long by 4 ft. wide, and 4 ft. 9 in. high; it was generally liked at the Frithville demonstration for its compactness, and was, in fact, one of the best of the small type machines. Three speeds forward, and one reverse are provided, and, although some doubt was expressed at Frithville as to its ability to work in wet weather without slipping, the makers claim that the speed attachments overcome this difficulty. At Frithville, Appleby, Cambridge, Northants, and East Suffolk (the demonstrations in which it was tried) it did good work, and required very small headlands. Under the conditions in which it was tried, the engine was easily capable of pulling the double-furrow plough, although not so fast at Appleby as the "Bull." The machine appears useful for slow haulage work; it is said to be able to pull 5 tons on the level. Two men were required for ploughing.

The Big Bull Tractor is a 3-wheeled machine with a powerful engine, capable of pulling a 3-furrow plough; its length is 13 ft. 11 in., and height 6 ft. 3 in. The driving wheel and the single-steering wheel run in the furrow, and do not pack the land.

Some Lincolnshire farmers thought that this arrangement of the driving and steering wheels, although generally com-

mendable, might be disadvantageous under certain conditions by consolidating the furrow bottom too much; on the other hand, it was noted at Cambridge, on the heaviest part of the land, that the single-tractor wheel in the furrow seemed inclined to churn up the subsoil.

The fact of the driving wheel running in line with the steering wheel makes the tractor automatically self-steering; it only needs driving round the ends. The tractor required 2 men to handle in the demonstrations, though the makers claim that 1 man can do the work when their own plough is fitted.

At Cambridge the tractor drew a 2-furrow plough, and ploughed a greater area than any other machine, working steadily through the day. At Appleby, 3 acres of land were well ploughed 5 in. deep in 4½ hours; in a test in Lincolnshire earlier in the year, 1 acre was ploughed in 1 hr. 50 min., a little over 2 gal. of petrol being consumed. The tractor left a narrow headland at Appleby, but was not particularly handy at the headland at Cambridge.

A point which was not tested was as to whether a 3-wheeled tractor is desirable for really stiff soil. Further, in Lincoln, the question was raised as to whether a 3-wheeled tractor is equal to a 4-wheeled one for haulage purposes, but apparently the draw chain adjustment at the back permits of an even and direct pull, and the single steering wheel is no disadvantage. The question of backing the machine might be a difficulty in reaping.

A feature of the machine is the ease with which the working parts may be inspected.

The Mogul Tractor is a very powerful machine pulling a 4-furrow plough. It is started on petrol, and runs on paraffin. It has 2 speeds forward, and 1 reverse. It is easily handled, having a steering mechanism of the motor-car type; all the working parts are well protected. It was tested at Frithville, Chelmsford, Moulton (Northants), and Bramford, and did good work. On account of its heavy weight, however, the wheels are apt unduly to pack the land. It was rather slow at Frithville, and, although ploughing 4 furrows against the "Bull's" 3 furrows, it did not get over so much work as the latter. It is too heavy a machine for small occupiers, and probably too expensive for ordinary farmers. The tractor can haul 10 tons on level roads.

The Daimler Tractor is another machine which is very heavy, and expensive for ordinary farmers; the makers intend to turn out a smaller and lighter machine after the war. However, it did very satisfactory work at the Lincoln demonstrations (it was not tried elsewhere), ploughing about 1 acre per hour. It pulls a 4-furrow plough. No delivery of these tractors can be obtained at present.

The Saunderson and Mills "Universal" (Model G) Tractor was tested at Frithville, Chelmsford, and Moulton. It was regarded, both at Frithville and Chelmsford, as an exceedingly useful general-purpose machine, and it seems to be one of the best of the more expensive types. An advantage is that it works on paraffin, the consumption of which, in ploughing, was put at 3 gal. per acre at Moulton, and about 4 gal. per acre at Chelmsford. The 1915 type of machine is stated to be a great improvement on older types. At Moulton it drew a 3-furrow plough at the rate of about ¾-acre per hour. It has 3 speed gears of approximately 2, 3, and 5 miles per hour forward, and 3 reverse speeds. It will haul a load of 5 or 6 tons at the rate of 5 miles per hour, and drive a 4-ft. 6-in. threshing machine.

The very powerful *Sandusky Tractor* was tried at Frithville, and pulled a 4-furrow plough with ease; the plough was fitted with a patent lever apparatus for lifting all the ploughs out of work, and letting them in again at the headlands, which does away with the necessity of a man at the ploughs. This tractor again seems too heavy and expensive for the ordinary farmer. It did much less than 1 acre per hour at Frithville. The wheels skidded on the loose soil surface when a trial of deep ploughing (10 in.) with a 3-furrow plough was carried out.

Good work was done by the *Ivel Tractor* at Chelmsford. This tractor has been before the public for 11 years, and its merits are well known.

The *Overtime* was tried at Moulton and Bramford, its work being very favourably commented upon. It drew a 3-furrow plough with ease, but required 2 men. As a light tractor at a moderate price it appears to be one of the most useful on the market.

Ransome's Steam Tractor was tried at Bramford. The soil, though light, was somewhat soft as a result of heavy rain the day before the trial, and the tractor was unable to demonstrate its powers. On firm, level land, however, there is reason to believe that this tractor is capable of doing good work.

The *Mann Steam Tractor* pulled a 4-furrow plough at Frithville, and did good work, but it is generally held to be more adapted to road work than ploughing. However, it ploughed evenly and well, and satisfied many of the larger farmers.

THE COMPOSITION OF WOOD AND PLANT ASH.

R. A. BERRY, F.I.C., F.C.S.,
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IN the autumn of last year, 1914, some ash analyses were made in the chemistry department of the West of Scotland Agricultural College. The object was to determine the amount of potash in the ash of certain forest and plant produce, with a view to the utilisation of the ash as a possible source of potash. Although several articles have since appeared in this *Journal** dealing with the same subject, the results obtained might still be of some interest.

The ashes, which were obtained by arrangement with the Forestry Department of the College, may be taken as being fairly representative, and they were produced and collected under conditions in operation in practice.

The percentage of potash soluble in (*a*) strong hydrochloric acid and in (*b*) water were determined; the results are given in the following table :—

Ash.	Potash (K_2O) : percentage soluble in		Percentage of "Total Potash"† soluble in water.
	Acid.	Water.	
Bracken	20·45	10·61	51·9
Spruce	11·94	8·23	68·9
Mixed forest produce	3·13	1·50	47·9
Hardwood, engine fire	10·44	6·77	64·8
Softwood, forest fire	11·79	6·53	55·4
Hardwood, largely oak trimmings	3·53	2·75	77·9
Flue dust from blast furnaces :			
No. 1	3·75	2·13	56·8
No. 2	3·93	2·64	67·2

Considered from the point of view of the total potash content it is clear that four of the ashes could quite well be used as a

* E. J. Russell, *Jour. Bd. Agric.*, Vol. xxi., No. 8, November, 1914.
C. T. Gimingham, *Jour. Bd. Agric.*, Vol. xxii., No. 2, May, 1915.
E. J. Russell, *Jour. Bd. Agric.*, Vol. xxii., No. 5, August, 1915.

† Total Potash = Potash soluble in strong hydrochloric acid.

potash manure in place of a low grade potash salt such as kainit, which contains 12·4 per cent. of potash. Indeed, on a valuation of the bracken ash on the basis of the potash soluble in strong acid, and taking the price per unit of potash previous to the war at 4s., the value of this ash would work out at about £4 per ton, whilst several of the other ashes would be worth about one half of this figure. Valued according to the current market price per unit of potash the price per ton would be considerably higher.

On the other hand, not much more than one half of the total potash is soluble in water, the soluble potash salt being mostly the carbonate of potash, so that it would appear questionable to value the ashes for manurial purposes on the basis of the total potash content only, whilst a valuation based upon the water soluble potash might give a low estimate of their true value.

Some of the ashes contain appreciable quantities of phosphates, which must be taken into account in judging the ashes for manurial purposes. The percentages of phosphates and other constituents are given in the following table:—

Ash.	Phosphoric acid expressed as		Lime. CaO.	Magnesia. MgO.	Manganese oxide. MnO.
	P_2O_5.	$Ca_3(PO_4)_2$			
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Bracken	3·37	7·35	10·90	3·69	0·84
Spruce	7·01	15·30	28·20	2·90	1·35
Mixed forest produce	1·54	3·36	12·40	2·03	0·47
Hardwood, engine fire	5·02	10·95	44·70	4·71	2·23
Softwood, forest fire	5·23	11·41	25·20	3·80	2·14

The phosphates present are practically all insoluble in water and are mostly in the form of calcium and magnesium phosphates. Their value for manurial purposes should be much the same as the value of the phosphates in steamed bone flour. Their presence in such relatively large amounts adds, of course, considerably to the value of the ash. The other constituents given in the table are, perhaps, of small interest only.

When the material is properly burnt, the ashes are bulky and of a light friable and powdery nature, generally grey in colour. If necessary they should be passed through a sieve of $\frac{3}{16}$-in. mesh, to get rid of stones and unburnt material. They must be protected from rain, otherwise the soluble potash salts

might all be dissolved out and lost. They are strongly alkaline and, when mixed with ammonia salts, liberate the ammonia freely, more especially if the ashes are damp; otherwise, with the exception of ammonia salts, ashes form a suitable medium for mixing with most manures. They must be stored in a dry place.

As the value of the ashes is judged by the amount of potash and phosphates which they contain, the following table may be useful for the purpose of comparison :—

Ash.	Total potash. K_2O.	Percentage of total potash soluble in water.	Phosphate of lime. $Ca_3(PO_4)_2$
	Per cent.	Per cent.	Per cent.
Bracken	20·45	51·9	7·35
Spruce	11·94	68·9	15·30
Mixed forest produce	3·13	47·9	3·36
Hardwood, engine fire	10·44	64·8	10·95
Softwood, forest fire	11·79	55·4	11·41
Hardwood, largely oak trimmings	3·53	77·9	2·40
Flue dust from blast furnaces :—			
No. 1	3·75	56·8	Not ascertained.
No. 2	3·93	67·2	

Apart from the chemical content, the economic importance of the ashes at the present time will depend upon the quantities available. The results of some recent investigations* given below will throw some light on this point.

1. From the "lop and top," undergrowth, weed growth, and litter in any average type of woodland, about ½ ton of ash is produced per acre.

2. From portable saw mills and foreign timber mills, where wood constitutes the fuel, about ¼ cwt. of ash per day is obtained as a by-product.

3. Ten acres of fully-stocked bracken land is found to produce 1 ton of ash, the quantity being dependent upon the density of the crop.

CALF REARING.

THE need for more stores has been keenly felt for many years by farmers engaged in fattening cattle for the butcher, and, even before the outbreak of war, store cattle were making very satisfactory prices. Raisers of cattle are now getting their full share of the high prices at which beef is selling, and cattle breeding is meantime a profitable business.

* See Leaflet No. 25, Bd. of Agric. for Scotland.

There is a similar demand for good heifers, and dairy farmers are paying high prices for heifers and young cows.

In these circumstances, and also from the point of view of the country's needs, it is very desirable that a sustained effort should be made to increase the numbers, and maintain and, if possible, improve the quality and usefulness of home-fed cattle. While it is true that the scarcity of labour is pressing heavily on many farmers at the present time, the fact should not be overlooked that calf-rearing may be carried on successfully, perhaps most successfully in many cases, during the winter months when work in the fields is relatively slack, and that calves may be tended by old men, intelligent lads, and women. Further, calves can often be reared with a minimum of labour and trouble—important considerations at the present juncture when farmers are starting calf-rearing for the first time and when labour is scarce. In this connection the attention of readers is specially directed to an experiment recently conducted at Woburn for the Royal Agricultural Society of England and referred to later. While, therefore, it should be the aim of feeders and dairymen to rear at least a proportion of the animals they require, it is probably to occupants of the smaller holdings, to farmers of upland or other grass land unsuited to cultivation, to owners of private parks, and, generally, to those who already rear a few calves, that the nation must look for the greatest extension of calf-rearing.

Methods of Calf Rearing.

The particular method adopted depends largely upon the system of farming practised. In this leaflet four methods, more or less distinct, are discussed under the following heads :—

1. Upland Grass Land.
2. Cattle-feeding Districts.
3. Milk-selling and Cheese-making Farms.
4. Butter-making Farms.

The care of the calf in early life is described fully in Leaflet No. 142 (*Calf Rearing*), and Leaflet No. 272 (*Supply of Store Cattle and Slaughter of Young Calves*), but the following general recommendations may be given :—

(1) There should be a plentiful supply of clean straw immediately behind the cow for the reception of the calf at birth.

(2) The navel cord should be rubbed at once with an antiseptic, *e.g.*, a lump of " bluestone " (copper sulphate), as

a precaution against infection. (Bluestone has the effect of causing the cord quickly to shrivel up.)

(3) The calf should receive the first-drawn milk of the cow—colostrum—the special nutritive and laxative properties of which are irreplaceable.

(4) It is essential to avoid giving too much food at one meal, especially after a fast, *e.g.*, when calves are purchased at a distant market.

(5) For the first three weeks the calf should be fed at least three times daily, with from 3 pts. to 2 qts. of milk at a meal; afterwards two feeds at equal intervals will be sufficient.

(6) All changes in diet should be effected gradually.

(7) All utensils should be kept scrupulously clean and the milk should be fed sweet and as near blood heat (about 101° F.) as possible.

(8) The calves should be housed in comfortable quarters with access to plenty of fresh air and sunshine. A cement floor, however suitable from the sanitary point of view, is too cold unless covered with several inches of peat moss or straw litter. A floor formed of either bricks, or earth, or rammed chalk is preferable. No stereotyped set of buildings is required. If the existing buildings are not quite suitable a little adaptation will usually suffice.

(9) A dose of castor oil should be given on the first appearance of digestive trouble. Mild cases may be cured by the addition of a little lime water, or a pinch of bicarbonate of soda, to the milk.

(10) Above all, every effort should be made to secure healthy calves of right type and breeding.

1. *Upland Grass Land.*

On upland farms in the South of Scotland and North of England, where plenty of cheap grass is available, cows are often allowed to rear their own calves. Such a method obviously saves labour, but is profitable only when the stock are of first-class quality and can be kept throughout the year at little expense, or when the sale of milk and its products is not the primary consideration. Galloway cows are crossed with a white Shorthorn bull with the object of producing blue-grey calves about the month of April. The calves run out at grass with their dams and are weaned about the end of October; afterwards the cows remain out of doors till Christmas, or even throughout the winter if provided with some form of shelter.

In other cases Angus cows are housed and calved down in sheltered yards and turned out to grass with their calves in spring, while in districts where the grass is of somewhat better quality, cows or heifers of Shorthorn breeding crossed with an Angus bull will rear their own and another calf in the course of the summer.

Calves thus reared are admirably adapted for the production of "baby beef" and usually command top prices when sold either as weaned calves or as stores or butcher beasts at from one to two years old.

For the production of dairy stock parents with a "milk pedigree" should be used.

2. *Cattle-feeding Districts.*

In non-dairying districts where the grass is of good quality, and winter keep can be grown cheaply, three or even more calves per cow, per annum, may be reared, according to the milk-yielding capacity of the cow. Under this system the best results are obtained when the cow calves in the early winter. Milk can be used most economically when hand-feeding is practised, but where this is impracticable the cow's own calf and another are put on to suck three times a day. In the intervals between meals they should be kept tied up near the cow or turned loose in an adjoining box. Preferably for the first month or so calves should be tied up; afterwards, when they have developed the power to ruminate and are less likely to suck each other, they may be turned, a few together, in a loose box, and be given some crushed oats or maize, linseed cake and bran together with some "fingered" roots and well-got hay. At the end of about 4 months the calves may be weaned and, if the weather is suitable, turned out to grass. The cow may then be given another calf, or two if she is a good milker, and be brought in from grass three times at first and later twice a day for suckling. On the whole foster calves are likely to do best when penned up and the cow is brought home for them to suck. They should have, however, the run of an open yard and be supplied with green food.

Cows calving in winter are likely to yield most milk in the course of a year, as the flush of the grass in spring and early summer tends to prolong the period of lactation. Where plenty of roots or other succulent food and good straw are available in winter, a cow, suckling two calves, should not require more than 2 lb. to 3 lb. of cake or meal daily in addition.

Where, however, winter keep is scarce, it will be better to let the cows calve down in April, milk each cow and distribute the milk among several calves, or, where this is impracticable, put two calves on to suck. The first couple may be weaned in due course and replaced by two more. With access to pasture during the winter, the cow should require little beyond some hay or straw and roots.

Calf-rearing on the lines described is peculiarly adapted to the circumstances of the small holder. Where close personal attention, either on the part of the owner or a member of his family, can be given, it is not unusual for as many as eight or nine calves per annum to be reared on a single good-milking cow. In such cases the usual procedure is to allow successive pairs of calves to suck the cow for about two months, during which time they have been taught to lick up meals from a trough and nibble at roots or grass.

A restive cow may usually be controlled by haltering and tying to the fodder-rack overhead, or by passing a rope tightly round her body immediately behind the shoulder.

3. *Milk-selling and Cheese-making Farms.*

On dairy farms, where the milk is sold or made into cheese, few calves other than heifer calves from the best-milking cows are reared. In view of the price obtainable for both milk and cheese, the ideal in these cases would be to rear on a milk substitute. Unfortunately, both experience and experiments show that to eliminate milk altogether in rearing is extremely undesirable, if not practically impossible. Much, however, may be done with a little milk judiciously supplemented with other foods. For the first three or four weeks a calf should receive, if it can possibly be arranged, only whole milk—about 1 gal. a day on the average. For the next three or four weeks, 5 pts. or 6 pts. of milk, daily, diluted with water or skim-milk, should be given, together with dry trough feed, such as equal parts of crushed oats or maize, linseed cake and bran, and, as soon as the calf will eat it, a little succulent food in the shape of "fingered" roots or grass. A calf may be quickly induced to lick up meal from a trough if a little be placed in its mouth immediately after drinking.

In trials conducted at Garforth* (Leeds University Experimental Farm), the following milk substitute proved quite satisfactory :—

Ground linseed	1 part.
Ground malt	3 parts.
Pea meal	6 „

* Paper on "The Rearing of Calves," read by Professor Seton at a meeting of the Farmers' Club, December, 1913.

The mixture was scalded and then reduced to the proper temperature (about 100° F.) with cold water. The substitute very gradually replaced the milk, and at the end of about one month, when the milk was entirely withdrawn, each calf was getting 18 oz. of the mixture per day. This was ultimately increased to a maximum of 2 lb. per calf per day, at which amount it remained till the calves were weaned at about six months old. The quantity of liquid, throughout, was 1½ gal. per calf per day.

Mr. W. T. Lawrence, of Newton Rigg, has used the following mixtures with success :—

No. 1.—Used for each calf when a small quantity of skimmed or separated milk is available :—

8 parts of oatmeal (by weight).
1 part of ground linseed.

Scald 2½ lb. over night with 5 pts. of boiling water, boil for 10 minutes next morning, and add 5 pts. of separated milk with about ½ oz. of salt and 2 oz. of sugar.

No. 2.—When no skimmed or separated milk is available :—

2 parts linseed cake meal.
2 ,, oatmeal.
1 part ground linseed.

Mix 3 lb. with 5 qts. of boiling water over night, and boil for 10 minutes next morning; add salt and sugar as with No. 1.

No. 3.—Requiring no boiling :—

14 parts linseed cake meal.
5 ,, ground linseed.
2 ,, wheat flour.
2 ,, locust-bean meal.

Mix 3 lb. with 5 qts. of boiling water and a sprinkling of salt.

Where No. 2 or No. 3 is used, it is introduced very gradually thus :—

First Week.—Mother's milk only.

Second and Third Weeks.—3 pts. of new milk and 1 pt. of the gruel at each of three meals.

Fourth and Fifth Weeks.—2 pts. of new milk and 2 pts. of gruel.

Sixth and Seventh Weeks.—1 pt. of new milk and 3 pts. of gruel.

Eighth Week.—2 qts. of gruel and no new milk.

Hay is given at the fifth week.

NOTE.—In preparing linseed for calves it should be boiled with water or very thoroughly scalded. If merely soaked in water (cold or warm) the conditions favour the production of a poison—prussic acid—sometimes latent, in small quantities, in samples of linseed. On the other hand, if fed whole or simply crushed, there is no risk of poison forming.

On cheese-making farms in Cheshire the following method* of rearing calves is successfully practised.

"Directly the whey is run from the curd, it is put into a large copper, and then heated over a quick fire. The

* Paper on "The Rearing of Calves," read by Professor Seton at a meeting of the Farmers' Club, December, 1913.

albumen coagulates, and, just before boiling point, rises to the top in flakes, known as "fleetings." These are skimmed off as they rise. The whey must on no account be allowed to boil, or the "fleetings" will sink to the bottom. To assist them to come it is often helpful to add 2 qts. or 3 qts. of cold whey. This also checks the bulk from boiling.

The boiler must be thoroughly cleaned out each day after use, and for this purpose a soft brick or rubbing stone is best. The calves are fed twice a day as follows :—

1st week—4 qts. milk per day.
2nd „ —6 „ milk per day.
3rd „ —6 „ —half milk and half "fleetings" per day.
4th „ —8 „ —2 qts. milk and 6 qts. "fleetings" per day.
5th „ —8 „ —1 qt. milk and 7 qts. "fleetings" per day.
6th „ —8 „ "fleetings" per day.

Milk is rarely given after the calves are six weeks old. As soon as possible a little soft or meadow hay is given to the calves, and when about a week old a little bran as trough food. When the calves are six weeks old, and are getting no new milk, a little linseed cake and kibbled oats in equal proportions are added to the bran. Each calf is allowed about ½ lb. of the mixture. This is gradually increased to about 1 lb. per calf per day. The calves are put out to pasture when they are finally weaned (about five months old), generally about the second week in June. The quantity of "fleetings" is gradually reduced, and in the last week only one feed per day is given. The weaning process extends over two weeks. If the weather is very wet or cold, the calves are brought in for a few nights, and get a little corn and cake, otherwise they are left out at pasture for about three months, and are entirely dependent upon the grass."

Whey is not well adapted for calf-rearing, for the casein as well as the fat of the milk has been removed in the making of the cheese. Calves, however, fed on whole milk for the first month have been found to thrive well subsequently on about 1½ gal. of warmed whey daily, together with crushed oats or maize given dry.

On most cheese-making farms, a certain amount of milk will be available in the winter months before cheese-making begins, which might be distributed judiciously among a number of calves during the first month or so of their existence.

4. *Butter-making Farms.*

Where butter is made, skimmed or separated milk is usually available for calf-rearing, and, in the absence of whole milk, there is no better basis for a calf food. The essential difference between whole milk and separated milk is that the latter

has been almost entirely deprived of its butter-fat or cream. In other respects the two are practically identical. In using separated milk therefore, the aim obviously should be to replace as much as possible of the fat removed by another fat possessing similar properties. Cod-liver oil and a form of dripping obtainable from large slaughter houses, as well as other oils or fats, have been used successfully in this connection, the usual allowance being from 2 oz. to 4 oz. per head, along with 1½ gal. of separated milk. Hand-skimmed milk contains more fat than separated milk and has been used alone for calf rearing, more or less successfully. A great drawback to its use, however, is the difficulty of preserving it fresh, and sour milk is prejudicial to young calves. Various meals are used as cream substitutes: of these one of the simplest and most wholesome is ground linseed. Whole linseed and maize meal in the proportion of 7 to 1 are run together through a grinding mill. (The maize meal serves the double purpose of preventing clogging of the mill and checking looseness of the bowels in the calf.) The meal is scalded and stirred with boiling water at the rate of 1 qt. of meal to 1 gal. of water: 1 pt. of this porridge is used to 4 pts. of separated milk.

The calf dietary for the first six months as above described may be tabulated as follows :—

First week.—Its own mother's milk three times a day, commencing with about 1 qt. and increasing to 2 qts. at each meal by the third day.

Second week.—2 qts. of new milk (not necessarily its own mother's) three times a day.

Third week.—2 pts. of new and 3 pts. of skimmed (or separated) milk, with ½ pt. of linseed porridge or half a tablespoonful of cod-liver oil, three times a day

Fifth week—3 qts. of skimmed milk, with 1 pt. of linseed porridge, or one tablespoonful of cod-liver oil three times a day, and a little sweet meadow hay.

Ninth week.—Mid-day milk and cream substitute omitted. 5 qts. of separated milk are given morning and evening, a handful of broken linseed cake (6 oz.) at mid-day, and hay.

Thirteenth week.—Milk as before, ¾ lb. mixed linseed cake and crushed oats, a few pounds pulped swedes (greenmeat in summer), gradually increasing, hay *ad lib.*

Twenty-first week.—Milk as before, 1 lb. of mixed linseed cake and meal, increasing quantities of roots, hay *ad lib.*

Twenty-fourth week.—Evening milk is discontinued.

Twenty-seventh week.—Milk altogether discontinued.

Separated milk should be poured into the calf pail clear of the froth.

Much of the time and trouble involved in making porridge and cleansing utensils is obviated by the use of cod-liver oil and other fat. It is necessary, however, to see that the oil is perfectly wholesome. In American experiments, very

good results have been obtained by feeding meals in the dry condition along with separated milk.

Crushed oats and separated milk appear to make an excellent diet for calves of from 4 to 12 weeks old. In an experiment at the Royal Agricultural Society's farm at Woburn the calves, up to the age of 3 to 4 weeks, received whole milk—about 1 gal. per head daily, on the average—and nothing else. Thereafter they were given, in addition to the milk, dry crushed oats as they would eat them, a handful at a time. For the first six days the calves each ate ¼ lb. oats and drank 1¼ gal. of whole milk. The whole milk was then gradually replaced by separated milk and the oats were increased to ½ lb. daily. After 24 days the whole milk was dropped entirely and 1½ gal. separated milk and 1 lb. oats were given daily. This feeding was continued till the calves were 12 weeks old. Within a week afterwards milk was given up, but the calves continued to receive oats, together with linseed cake and hay, and were turned out to grass. During the 9 weeks of experimental treatment the calves increased in weight at the rate of almost 2 lb. per head per day.

The fact that starch in food is digested only after it has been converted into sugar in its passage through the alimentary tract, probably explains, to some extent, why starchy food, such as oats or maize give better results when fed dry than when gulped down with milk. The conversion of starch into sugar is effected largely by the saliva in the mouth, and the more slowly and thoroughly a starchy food such as oats or maize is chewed and mixed with saliva the greater is the proportion of starch that will be converted into sugar. Of course, in addition to starch, these grains contain quite appreciable quantities of oil and albuminoids. In 1 lb. of oats, however, there is only about 1 oz. of fat, whereas in 1½ gal. of whole milk there should be about 8 oz. It would appear, therefore, that in the feeding of calves, as with other animals, fat, to some extent at least, can be replaced by starch.

Careful attention during weaning is all important. On no account should the calves be allowed to lose condition. If at grass they should be housed early in autumn with a view to preventing Husk or Hoose, and the feeding should be such as to encourage uninterrupted progress. For particulars of suitable rations for young cattle readers are referred to the notes on feeding stuffs which appear monthly in the Board's *Journal*.*

* Reprints of these notes may be obtained free of charge on application to the Board.

TOP-DRESSING WHEAT IN AUTUMN.

As a means of increasing the supply of home-grown wheat, a return to the old practice of top-dressing the wheat crop with nitrogenous manures in autumn may be recommended.

Increase Produced by Top-dressing.—Long ago, Lawes and Gilbert, as the result of their first twenty years' experience at Rothamsted, came to the conclusion that with land of poor or moderate quality an increase of from 5 to 6 bush. of wheat per acre might be expected from the application of 1 cwt. of sulphate of ammonia in autumn. This conclusion had reference to quantities of 43 and 86 lb. of nitrogen per acre (equal to the amounts present in dressings of 2 cwt. to 4 cwt. sulphate of ammonia) and to soils which, without a nitrogenous manure were capable of yielding from 18 to 28 bush. of wheat per acre. In this *Journal* for September, 1915, Dr. E. J. Russell, Director of the Rothamsted Experimental Station, pointed out that for the long period of 61 years a dressing of ammonia salts equal to about 2 cwt. sulphate of ammonia has increased the wheat crop by 8·7 bush., and that double the dressing has produced 17·6 bush. increase; this increase is at the rate of nearly $4\frac{1}{2}$ bush. of wheat per cwt. of sulphate of ammonia.

For reasons which need not be discussed here, there have been very few experiments on the autumn top-dressing of wheat, and there is no extensive series of tests on land under ordinary rotation by which we can check these estimates based on the permanent wheat plots at Rothamsted.

The experiments at Rothamsted may, however, be accepted as sufficient to establish the following proposition. *If prudence be exercised in applying nitrogenous manures, so that they are used on suitable soils and at the proper times, there is good reason to anticipate an increase of one sack (240 lb.) of wheat per acre as the result of an application of 1 cwt. sulphate of ammonia in the late autumn, and a further increase of one sack per acre as the result of an application of 1 cwt. sulphate of ammonia or $1\frac{1}{3}$ cwt. nitrate of soda in spring.* So great an increase could not be expected from wheat land of high quality yielding in an ordinary year without direct manuring 40 bush. per acre and over; neither could this increase be expected on light land unsuited to wheat unless the season proved unusually favourable (dry from December to March, and moist from April to June), nor could the increase be expected on neglected land full of couch and bent grasses.

There are now 2,000,000 acres under wheat in this country, and assuming that the crops on about 1,000,000 acres are

suitable for top-dressing, and that the season proves moderately favourable, the application of nitrogenous manures as above described would result in the addition to the 1916 crop of 1,000,000 qr. of wheat. This increase of home-grown food requires scarcely any effort; the labour involved in top-dressing is trifling, and is more than saved later in the year, since top-dressed crops are likely to smother annual weeds.

If dressings of 2–2½ cwt. per acre of a nitrogenous manure, partly in autumn and partly in spring, are applied with discretion, the profits should be substantial, and at the worst, in the event of the coming harvest year proving to be very unfavourable, there is not likely to be any considerable loss from following the policy advocated, unless the manure is used with lack of judgment and rich loamy soils are over-dressed so that the crops become laid badly in June.

Autumn v. *Spring Top-dressing.*—In ordinary circumstances, when applying small dressings of ¾ cwt. to 1 cwt. per acre of a nitrogenous manure, the best results on the average are got from spring top-dressings, and these are almost universally recommended. But where the nation's interests require patriotic farmers to grow the largest crops that their fields can produce, autumn as well as spring manuring is called for, and the Board, therefore, recommend that for the crop of 1916 from one-third to one-half of the total dressing of nitrogenous manure should be applied in the late autumn, and the remainder in the spring.

Formerly, sulphate of ammonia was usually applied for wheat in the autumn because it was thought that the soil fixed this manure and prevented loss by drainage; but about 35 years ago it was shown at Rothamsted that the ammonia quickly changed into nitrates in the soil, and that a good deal of what was applied in the autumn might be washed out during the winter (Lawes and Gilbert remarked at the time, that in spite of losses the autumn dressings did much good). Recent experience at Rothamsted has shown that in dry years an autumn application is best and in wet years a spring dressing. On the average as between autumn and spring the latter has a substantial advantage, but when the period December to March has been moderately dry and mild, and the early summer dry and cold, autumn manuring has been proved to be much the more effective.

Keep the Wheat Plant Growing.—A forecast of the season cannot be made, but a study of the effects of weather on field crops and of the influence of past seasons on the yield of wheat

furnishes hints for those who are endeavouring to grow a heavy crop in 1916. An examination of the Rothamsted records shows that the finest wheat crop ever grown there was that of the year 1863. The character of the weather of this harvest year was: November cold and dry, December and January mild and moderately moist, February and March mild and dry, April very dry and warm, May and June cool with a sufficiency of rain, and July dry and bright. Commenting on this wonderful wheat crop, Lawes and Gilbert say: "the extraordinary result was due to the almost unchecked growth from the first appearance of the plant above ground up to the time of harvest rather than to any extraordinary characteristics of the season." This statement supplies a hint for the farmer who desires to produce a bumper crop of wheat; it is obvious that in 1916 "keep the plant growing" should be his maxim.

Critical Periods in Winter and Late Spring.—If growing wheat crops are watched, or the records of seasons are studied, it will be remarked that there are two critical periods in the early development of the young wheat plant, viz.: the period from Christmas to about the end of February, when it is struggling in a wet soil, and the period in April and May when, if badly rooted, it may be greatly injured by drought. The purpose of an autumn top-dressing is to supply the struggling plant with food in the period from Christmas to March so that it may develop roots and make some growth when the weather is mild. An autumn application of manure is more subject to loss in the drainage water than a spring application, but, unless the season is quite exceptionally bad, the manure will benefit the plant in spite of the losses through drainage. The washing downwards of a nitrogenous dressing during winter and spring has even some advantages, since roots follow manure and deep rooting is thereby encouraged. If a cold and dry April and May follow a mild and fairly dry early spring the value of an autumn top-dressing of sulphate of ammonia may be very marked indeed.

Time to Apply Sulphate of Ammonia in Autumn.—The usual practice is to apply late in October or early in November; but it is doubtful if this is the best time for general application. In the early autumn the earth is warm, and in most cases the young wheat plant has no difficulty in meeting its needs from the nitrogen of the soil. In poor and cold soils where the wheat plant is backward, it would probably be advisable to top-dress in November. If the young plant is growing well, however, it will be better to keep back the top-dressing until December. Recent work at Rothamsted has shown that,

given open weather, nitrification (that is the change of ammonia into nitrate, the substance upon which the plant feeds) proceeds during the winter to a greater extent than was formerly supposed; although the change becomes very slow below 40° F., nitrification goes on in any part of the soil not actually frozen. Given ordinary winter weather, manure intended to help the crop through the first three months of the year may be applied up to about 1st January. The objection to applying sulphate of ammonia early in the autumn is that spells of very wet weather often occur between the middle of November and the middle of December, and if there were a heavy fall of rain while the soil is still warm, much of the manure may be washed out before the plant requires it. Later on, when the soil gets colder, the danger of loss is much reduced.

Recommendations.—The following suggestions are made for the guidance of those who intend to use sulphate of ammonia during the autumn. The quantities of manure given are for one acre of land :—

1. Rich loams, highly manured clay soils, or good fen soils likely to grow 40 bush. of dressed wheat and over in an ordinary season need have no autumn top-dressing.

2. All ordinary clay soils likely in an ordinary year to produce 32 to 40 bush. of wheat, on which the young plant is in fair condition, should get from ¾ to 1 cwt. sulphate of ammonia about the middle of December.

3. Similar soils on which the young crop is poor and backward should get ½ cwt. sulphate of ammonia in the middle of November and ½ to ¾ cwt. towards the end of December.

4. Poor clay soil producing 24 to 32 bush. in ordinary years should get ¾ cwt. sulphate of ammonia and 3 cwt. superphosphate of lime in the middle of November and ¾ cwt. sulphate of ammonia about the end of December.

5. Good soils of medium texture producing 30–40 bush. in ordinary years should get 1 cwt. sulphate of ammonia about the middle of December.

6. Poor soils of medium texture producing 20–30 bush. in ordinary years should get ½–¾ cwt. sulphate of ammonia and 3 cwt. superphosphate in the middle of November and ¾ cwt. sulphate of ammonia about Christmas.

Through the Sulphate of Ammonia Association the Board have made arrangements by which manufacturers of sulphate of ammonia will reserve a supply of manure for autumn top-dressing. This supply will be sold during November and December at prices not exceeding £14 10s. net cash per ton f.o.r. at the maker's works, in bags, in lots of 10 cwt. and upwards.

Farmers are recommended to purchase early for, if the demand proves to be greater than anticipated, and the reserved stock is sold out, current market prices must be paid.

The President of the Board has appointed a Committee to make arrangements for the supply of fertilisers. Farmers who have any difficulty in securing supplies of sulphate of ammonia at the prices stated should communicate at once with—*The Secretary, Board of Agriculture and Fisheries (Fertilisers Committee), 3, St. James's Square, London, S.W.*

TRANSPORT OF AGRICULTURAL PRODUCE.

How can growers economise in the transport of produce by rail and promote safe and rapid delivery?

Several of the railway companies have now on sale, at all of their stations from which produce is forwarded, light and cheap boxes. The Great Western Railway Company and the South Eastern and Chatham Railway Company supply boxes as under :—

	G.W.R.						S.E.C.R.						
	Length, in.		Breadth, in.		Depth, in.		Length, in.		Breadth, in.		Depth, in.		Price, each.
No. 1..	10¾	×	7½	×	3		10¾	×	7½	×	3		2½*d.*
„ 2..	13	×	9	×	4½		13	×	9	×	4½		3*d.*
„ 3..	15¾	×	10¾	×	5		15¼	×	10¾	×	5		3½*d.*
„ 4..	16¾	×	11¼	×	5½		16¾	×	11½	×	5½		4*d.*
„ 5..	18½	×	13	×	6		18½	×	13	×	6		5*d.*
„ 6..	21¾	×	15	×	7		21¾	×	14	×	7		6*d.*

The inconvenience of returning empty packages may be avoided by the use of these boxes.

Damage in Transit.

When certain kinds of agricultural machines and implements are carried by the railway companies at the owner's risk and are damaged in transit, they may be returned to the senders for replacement *free of charge for carriage*, provided they are returned within two weeks from the date of being tendered by advice or otherwise.

This concession applies to agricultural carts and wagons; chaff cutters; corn crushers; oil-cake mills; root cutters and pulpers; and other machines for preparing food for agricultural purposes. It does not apply to iron harrows; land rollers; clod crushers; horse gearing machinery; steam engines, portable, vertical, or horizontal, in lots under 1 ton; vegetable washing machines.

Cartage Rebates.

Certain rates called " Collected and Delivered " or " C. & D." rates include charges for cartage to and from the stations. Where goods consigned at these rates are carted at either end of the journey by the consignor or consignee an allowance known as a cartage rebate becomes due from the railway company, and may be obtained on application by the person who has paid the rate.

Packing and Despatch.

Great care should be given to packing. If through being insecurely fastened a package comes open in transit, the railway company may contend that any loss that may result is due to defective packing, and that, therefore, they are not liable. If boxes are used they should be secured by nails and not by rope or cord. The reason is that it is difficult to remove the contents of boxes which have been nailed up without leaving evidence of pilfering, and where such evidence exists railway companies are generally prepared to pay compensation, even though the goods were carried at owner's risk.

Addressing.

Much delay and loss is caused by failure to address consignments sufficiently and to send them to the station in time to be loaded before the train is due to start. Consignors should remember that an address which is legible to themselves is not always legible to other people, and that the late arrival of their goods at the station may cause loss not only to themselves, but also to their neighbours, whose consignments may be carried by the same train.

Where to Enquire.

Most of the railway companies have special literature on this subject, and this will be sent on receipt of an application to the General Manager of the company concerned.

" Bulking."

The " bulking " system is recommended as a means of effecting a considerable saving in the cost of conveyance of goods, both as regards sales and purchases.

The following are the railway rates for the conveyance of plums from the Vale of Evesham to London :—

Small lots, per ton.	10-cwt. lots, per ton.	1-ton lots, per ton.	2-ton lots, per ton.	3-ton lots, per ton.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1 8 0	1 3 10	1 2 1	1 0 10	1 0 4

Much higher rates, however, may be legally charged under the "small scale for lots under 3 cwt." The railway company's charges, for instance, for the conveyance of three small lots of plums from Evesham to London are as follows :—

cwt.	qr.	lb.		s.	d.
0	2	0	.. ..	1	3
1	0	0	.. ..	1	11
1	2	0	.. ..	2	8

Assuming that ten Evesham fruit-growers, each having 1 cwt. of plums to send to London, agreed to bulk their several lots and forward them as one consignment, the railway company is bound to calculate the carriage in this way :—

cwt.	qr.	lb.		s.	d.
10	0	0	@ 23*s.* 10*d.* per ton ..	11	11

The cost of conveyance of each lot would then be just under 1*s.* 2½*d.* as against 1*s.* 11*d.* if sent as a single parcel. The more lots there are in the consignment the better it will be for each individual, because, as the weight increases, the rate decreases *pro rata.*

Take another example. The rates for apples and pears between Evesham and London are :—

Small lots, per ton.	10-cwt. lots, per ton.	1-ton lots, per ton.	2-ton lots, per ton.	3-ton lots, per ton.
£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
1 3 2	0 18 0	0 17 4	0 16 6	0 16 0

The cost of conveyance of a consignment of apples weighing, say, 2 cwt. (on the "Small's" scale) would be 2*s.* 9*d.*; but if twenty such lots were bulked and sent forward as one lot, the carriage would be charged at 16*s.* 6*d.* per ton; total, 33*s.*, or 1*s.* 8*d.* per 2-cwt. lot. *There would be, therefore, a saving of* 1*s.* 1*d.* *in the carriage of each consignment.*

This method of consigning can be employed with equally beneficial results in any district, and in connection with the carriage of many kinds of agricultural produce and requisites. Growers should take care to inform themselves on the position.

The system has its limitations. For example, when consignments destined for a number of consignees are aggregated it may be that the extra cost of delivery is in excess of the gain derived from the cheaper rate. It is necessary, therefore, that senders should consider in each case the advantages and disadvantages of the various methods of consignment open to them.

CO-OPERATIVE FARM IMPLEMENT SOCIETIES (*continued.*)

T. WIBBERLEY, N.D.A., N.D.D.,
Agricultural Expert to the Irish Agricultural Organisation Society.

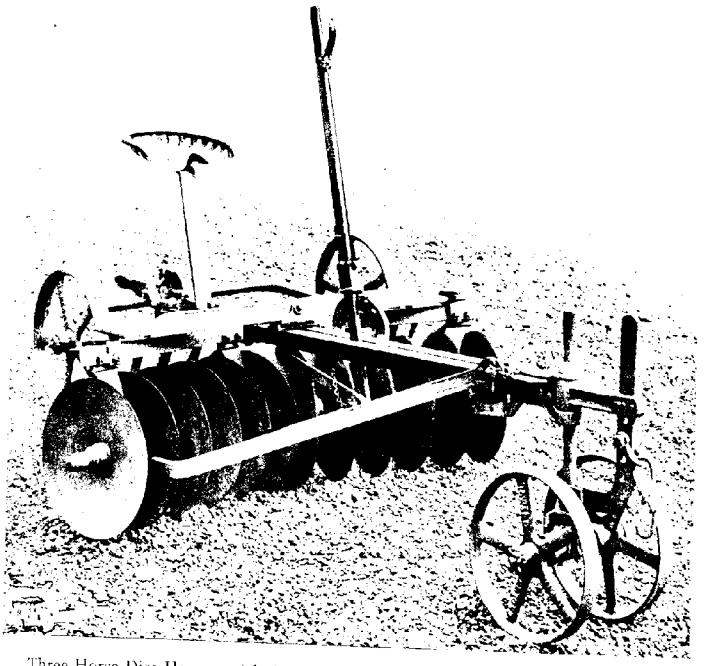
Cultivating Implements.

OF all the agricultural implements which have been invented during the past generation, it is doubtful if there is one more useful than the disc harrow. The term harrow applied to this implement is a mis-description. The machine is really a combination of a plough and a pulverising cultivator. As will be seen from the illustration the implement consists of two sets of concave discs, fitted on a central axle. As the implement is moved the discs revolve, inverting and breaking up the soil at the one operation. The two sets of discs are controlled by a lever, and the more forward this lever is pushed the greater the angle at which the discs run to the line of draught, and the deeper they cut into the soil. Deeper work is also obtained on those machines fitted with a swivel and adjustable front by elevating the front of the machine, lowering the draught, and also by hanging weights on the axle of the transport wheels at the back.

Disc harrows are divided into two chief classes, viz., horse discs and motor discs, which may be described under separate heads. Before giving these descriptions, however, it will be of interest to describe the varied use and capabilities of disc harrows.

Generally speaking it is no exaggeration to say that with the exception of very light or stony land, the introduction of the disc harrow reduces the labour, time, and cost of cultivation by 50 per cent. For example, on stubble land where, in order to prepare it for a root crop, it is customary to plough, cultivate once or twice, and sometimes also cross plough, one ploughing followed by a disc harrowing in both directions generally suffices to bring the soil into a fine enough state for drilling. Before drilling, however, it is necessary to level the land with a spring-tooth harrow as the disc leaves the land in ridges. Even on very heavy clays, the writer has found that one ploughing is all that is required for a drill crop, provided that the stubble is double disc harrowed both before and after ploughing.

A statement which will give the practical farmer a better idea of the economy effected by a disc harrow is that a double disc harrowing of an acre of land can be carried out



Three-Horse Disc Harrow with Swivel Front and Fore Carriage. Also suitable for a 10-B.H.P. Tractor.

20-B.H.P. Model Tractor hauling a 10-ft. Disc Harrow on sun-baked clay land. Note the effectiveness of the tillage.

with one man and a team of three horses in from 1½ to 2 hours. Double disc harrowing is best performed by working the land in "setts" as in ploughing, so that the near or "off" set of discs half overlaps the stroke made on the previous journey. This will mean that the piece of land which was disc harrowed by the left or "off" side of the machine in number one stroke will be cut in the opposite direction by the right or "near" side of the machine in number two stroke and, as a result, will be more completely pulverised.

It is also very useful to know that the disc harrow works all the better when the land is firm, so that in tilling cloddy land it is often a great advantage to roll the land before discing.

In the tilling of medium stubbles for roots, providing the land is fairly clean, the writer often dispenses entirely with ploughing. This is accomplished by several disc harrowings in both directions, alternating every stroke of the disc with a strong cultivator. By this means such a soil can be worked to a depth of 6 in. or 7 in., the spring-tooth harrow and roller being, of course, used in securing a fine tilth before drilling. This method is also followed in tilling a corn stubble for a crop of tares, and in tilling a tare stubble for a crop of giant rape or other type of winter greens. The entire cultivation of an acre of land in the above manner with either three horses or a light motor, takes from 5 to 8 hours. One great feature of quick cultivation, which is worth keeping in mind, is that it helps the conservation of soil moisture. The advantage thus derived is most pronounced in the autumn and summer tillage, which is necessary in the case of tares and winter greens respectively.

The Discing of Lea Land.—It is in the tilling of lea land for a drill crop that a disc harrow shows to the greatest advantage. In progressive potato-growing districts it is well known that the best crop from the standpoint both of quality and quantity can be obtained from the lea. The difficulties, however, of tilling lea for a drill crop, with ordinary implements, are often prohibitive, but, with the assistance of a good disc harrow, the cultivation of such land in the manner indicated presents no more difficulty than does the usual practice of cultivating the stubble for a root crop with ordinary implements. Where it is desired to till lea for potatoes or roots, the best method of carrying out the operation is first to disc harrow the grass land in both directions before ploughing, then plough, using a skim coulter to bury the "turves," and disc harrow the land several times, first

in the same direction as the ploughing and then across. If the first discing and ploughing are done in early winter and the land is allowed to lie 2 or 3 months before further cultivation is undertaken, cross ploughing is seldom necessary. All that is usually required to complete the cultivation are the subsequent disc harrowings indicated and the levelling of the land before drilling with an ordinary spring-tooth harrow. On very tough clay land cross ploughing may be necessary, especially in a winter when there is little frost. Under such circumstances the land should be disc harrowed, before the cross ploughing, otherwise this operation cuts the old furrow into big square pieces and makes the subsequent cultivation very difficult.

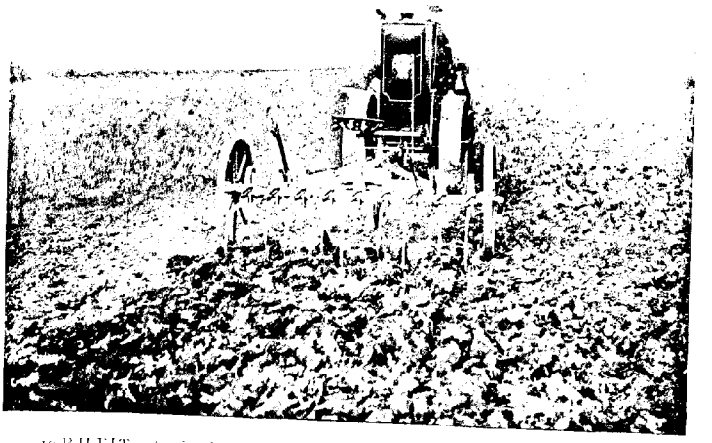
*Types of Disc Harrows.**—Both the horse and motor types of disc harrows are made with different kinds of discs.

There is the plain type of disc, and the serrated or cut-away type in which portions of the periphery of the disc blades are notched. In theory this arrangement is supposed to allow greater penetration into the soil than is possible with the plain disc. This claim is not borne out by practical experience, and, furthermore, the pulverising effect of the plain disc is greater than that of the cut-away type. Another type of disc harrow is called the spading disc, which has, in place of a plain or notched disc, six or more curved blades forming a kind of sprocket wheel. This type is specially suited for land containing a number of small stones, on which class of land the previous types are not of much use.

In some makes of horse disc harrows a shaft is provided to which the horses are attached in the same manner as they are hitched to a mowing machine or corn binder. Another type, in place of a shaft, has a fore carriage and swivel front. The latter has many advantages over the former. The shaft type racks the horses' necks, the draught cannot be raised or lowered, and the implement does not keep as steadily to its work as one provided with a fore carriage.

The number and sizes of the discs on the horse implement vary. The most useful type for a three-horse team is a disc harrow with 12 discs, each disc 20 in. in diameter. With this implement a certain amount of work can also be done with two horses, by removing the two outer discs, setting the disc at a smaller angle, and in certain cases lightening the draught by entirely removing the transport wheels. As

* The information given is based on Irish experience and may not be suitable for conditions in all parts of England.



10-B.H.P. Tractor hauling a Triple Cultivator on an Unploughed Rape Stubble.

10-B.H.P. Tractor hauling a Triple Cultivator with Mould Board Attachments for opening three drills.

a rule disc harrows described as two-horse implements have from 10 to 12 discs which vary in diameter from 14 in. to 18 in. In actual dynamometer trials which the writer has conducted, working at a uniform depth, with discs of various diameters, the larger the size of the disc the lighter, as might have been expected, is the draught. Hence the so-called two-horse machine requires a greater haulage force than does the larger type. Further, clogging is less liable to take place with the implement fitted with discs of big diameter than with one having smaller discs.

Motor Disc Harrows.—There is no fine line of demarcation between a horse and a motor disc. The heavy horse disc is equally well suited for use with the light motor. In this connection it will be useful to know that the three-horse disc is suitable for a 10-b.h.p. motor, whilst a motor of double this power can successfully haul a five or six-horse implement. The type which might, properly speaking, be described as a motor implement proper, is the double disc harrow. In this implement there are two double sets of discs, one set running immediately behind the other. The hind set of discs is usually arranged to cut in the opposite direction to the fore set. There are also single disc harrows made for motor work. These are built on the same lines as the horse disc, but have from 16 to 24 discs, and vary in width from 8 ft. to 12 ft. For a very sound reason the double disc harrow is the better implement. The wheel spread of an agricultural motor is usually about 6 ft., so that when such a motor is hauling a disc harrow of a greater width than 6 ft., *e.g.*, when overlap or double disc work is being performed, the motor is compelled to run on the freshly broken surface. This has two disadvantages. A loose surface results in back-slip taking place, and consequent loss of haulage power. Furthermore, a heavy motor running over the freshly turned-up soil compresses the land, and, to a certain extent, neutralizes the cultivation already done. Many makers claim that a motor does not press the land to a greater extent than is done when horses are used. They attempt to prove this statement by referring to the fact that the pressure per square inch is greater in the case of horse labour, where the pressure is concentrated, than when the pressure is distributed over the area covered by the motor wheels. This is mathematically true, but it should be borne in mind that a horse only presses the land on a comparatively small area, whereas the motor compresses the surface of the soil on the entire area passed over by the wheels.

That the popularity of the disc harrow is increasing may be gathered from the fact that eleven years ago there were not a dozen disc harrows in Ireland, and to-day, according to the Irish Department of Agriculture's latest census of implements, there are 2,000.

The Triple Cultivator.

Another implement which might be in more general use is the triple cultivator. This is really a combination of implements. In the first place the tines may be arranged so as to do ordinary cultivating work. They may also be arranged in sets of three, so as to grub or cultivate three drills at a time. In addition, moulding boards may be fitted so that three drills at a time may be opened or closed, and re-moulded up after cultivating operations. The economy of such an implement, where potatoes, roots, or other drill crops are grown on an extensive area, is very great. Not only is there a great saving as regards horse and manual labour, but every possible advantage can be taken of good weather conditions to push on with the work. This is an important consideration in the after-cultivation of root crops, which generally clashes with the hay and early corn harvests.

Many farmers imagine that the haulage power required to open, say, three drills is very great. This, however, is not the case. As a matter of fact, wherever two horses are capable of opening a single drill with the ordinary moulding plough three are easily able to open three drills with the triple cultivator, the reason for this being that in the case of the cultivator the weight of the machine is borne by the wheels.

In purchasing a triple cultivator care should be taken to obtain one with an expanding axle. This permits of the distance between the wheels being increased or decreased as desired. With an expanding axle drills may be made up to 36 in. wide—a very useful width where intercropping with potatoes is followed—or the drills may be as narrow as 18 in.—a width which may be used where beans are sown as a cleaning crop, or where such crops as kale, rape, etc., are grown in rows, on raised ridges. Where intercropping is followed, the wheels and mould board may be so arranged that the second or auxiliary drills can be opened for the planting of late potatoes or roots when the first crop is well advanced in growth. As will be understood, the opening of the auxiliary drills with such an implement helps to earth up the earlier planted potatoes.

A PRELIMINARY REPORT UPON THE ECONOMIC STATUS OF THE BRITISH SPECIES OF WOODPECKERS AND THEIR RELATION TO FORESTRY.

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THE economic status of the British species of Woodpeckers has long been a subject of dispute, and opinions regarding their usefulness or harmfulness, from the standpoint of the forester, are very varied.

It has often been stated that these birds damage sound trees by pecking holes in them or girdling them, and that they also wound saplings, feed upon the seeds of coniferous and other trees, and damage telegraph posts, but, in the absence of any systematic investigation into the nature of their food or the extent of damage they commit, it was difficult to say whether there were any grounds for such statements. In view, therefore, of the recent activities in re-afforesting large tracts of land in this country, the present investigation was commenced in order to obtain more exact knowledge of the habits of these birds.

For various reasons it has been found necessary to postpone the investigation, and as it will, therefore, be some little time before it is possible to complete it, it has been thought advisable to issue the present preliminary report.

Species Dealt With.—There are three species of woodpeckers in the British Isles, viz., the Great Spotted Woodpecker, *Dendrocopus major* (Linn.); the Lesser Spotted Woodpecker, *Dendrocopus minor* (Linn.); and the Green Woodpecker, *Gecinus viridis* (Linn.). The latter is by far the commonest, and the majority of the observations made have been on this species.

Examination of Stomach Contents.—Up to the present time 91 specimens have been examined, viz., 5, Great Spotted Woodpecker; 8, Lesser Spotted Woodpecker; and 78, Green Woodpecker. Fully 75 per cent. of the food has been found to consist of injurious insects, the principal species being :—

Osier Weevil (*Cryptorrhynchus lapathi*, Linn.).
Pine Weevil (*Hylobius abietis*, Fabr.).
Bark Beetles (Various species of *Tomicus*).
Pine Beetle (*Myelophilus piniperda*, Linn.).
Ash Bark Beetle (*Hylesinus fraxini*, Pz.).
Elm Bark Beetle (*Scolytus destructor*, Oliv.).
Black Pine Beetle (*Hylastes ater*, Payk.).

Small Poplar Longicorn (*Saperda populnea*, Linn.).
Common Longicorn (*Rhagium bifasciatum*, Fabr.).
Rhinoceros Beetle (*Sinodendron cylindricum*, Fabr.).
Shot-borer Beetle (*Xyleborus dispar*, F.).
Larvæ of the Pine-shoot Tortrix Moth (*Retinia buoliana*, Schiff.), the Birch Clearwing Moth (*Sesia culiciformis*) and the Wood Leopard Moth (*Zeuzera aesculi*, Linn.) have also occurred.

Of the remaining 25 per cent. of food, quite 20 per cent. consisted of ants, the further 5 per cent. being made up of 1 ladybird beetle, 2 spiders, and insect remains not identifiable.

Field Observations.—In the field observations the objects kept in view have been to obtain first-hand information on the following points: (1) the distribution of woodpeckers, (2) their nesting habits, and (3) their feeding habits. Considerable difficulty has been experienced in obtaining information on all these points, and the results have frequently been at variance with those obtained by local observers.

Briefly, the results of field observations to date may be summarised as follows:—

1. *Distribution.*—In many parts of the country the Green Woodpecker (*Gecinus viridis*, Linn.) has increased in numbers during the past 4 or 5 years. In a few localities it has decreased, and in a few others it has appeared for the first time.

2. *Nesting Habits.*—Beyond the fact that the writer has confirmed in upwards of 40 cases that where holes were made in trees for purposes of nesting, the trees were in all cases already injured or decaying, no new information has been obtained.

3. *Feeding Habits.*—Numerous observations in the open fully confirm the following two facts:—(1) that sound trees are seldom, if ever, attacked, and (2) that large numbers of insects are destroyed by woodpeckers. A careful investigation, extending over two years, shows that of upwards of a hundred trees attacked by these birds not a single one was previously sound. In this connection a practical forester writes to me: "Personally I always allow an ample margin in measuring a tree with a woodpecker hole in it, and generally find in timber-measuring that if I continually hear woodpecker calls, I am among a lot of unsound timber" (Surrey). Another states: "I have seen many trees blown and cut down, which have been bored into by woodpeckers, but I have found the trees more or less decayed, and there are plenty of such trees about here (Gloucester) now standing." Other letters and verbal communications bear out the above statements.

The quantity of insects eaten as food is in some cases surprising; thus in one case upwards of 1,300 beetles were found in the stomach, in another 1,100, and from 300 to 800 were common. Of the larvae of the larger timber-destroying beetles the remains of 57 examples of *Rhagium* represented the largest number found in one bird.

Observations on the Food of Nestlings.—Only two nestlings have been examined; these were from different districts, and of the Green Woodpecker. The stomach contents in both cases consisted entirely of beetle larvae.

Examination of Faeces.—Considerable difficulty has been experienced in obtaining the faeces of birds in the wild state, and the few examples examined are insufficient to enable any definite conclusions to be drawn. So far only insect remains have been discovered, and there is no evidence that would support the view, held by some foresters, that woodpeckers disseminate the seeds of weeds.

Relation to British Forestry.—From observations made in the laboratory and field, extending over two years, there is no doubt that woodpeckers are distinctly beneficial to forestry, and merit all the protection that can be afforded them. From an examination of the stomach contents alone, it would be impossible to come to any other conclusion. If, in addition, it is borne in mind that the birds destroy large numbers of timber-destroying insects during the nesting season, their value will be better realised.

As stated above, the writer has not met with a single case where sound timber has been attacked, and he has been unable to learn of a single authenticated case from the many foresters consulted or written to during this investigation.

Roman or Italian Geese.

THE Roman goose is found in southern Europe, chiefly in south Germany, Austria, Hungary, and Italy. It is a useful variety which is, however, not well known, and the breed appears to be uncommon in England.

Two varieties of Italian geese are found, one being pure white in plumage and the other parti-coloured. The birds are long in body, with a fine head and a short, thick beak, which is orange-red with a white tip. The wings, which are large, are carried well back, and the legs are of medium length. W. Godwin describes the parti-coloured variety as white with a blue-grey head, a grey spot between the shoulders, and a marbled-grey

patch on each thigh. Both sexes are marked alike and are attractive looking. The marks are reproduced almost without variation, so that the variety possesses a fixed type.

Italian geese are smaller in size than the breeds usually found in northern and western Europe. When fully grown they weigh from 12 lb. to 14 lb., while at the age of from 6 to 8 months they weigh about 8 lb. or 9 lb.

These geese are very precocious and rapid in growth. They are chiefly remarkable for their great prolificacy in egg-laying, the average production being, in many cases, as high as 100 eggs per head per annum. According to Tegetmeier, 60 and 70 eggs have been produced by one of these birds in the spring, while very frequently the birds lay also in the autumn, after moulting.

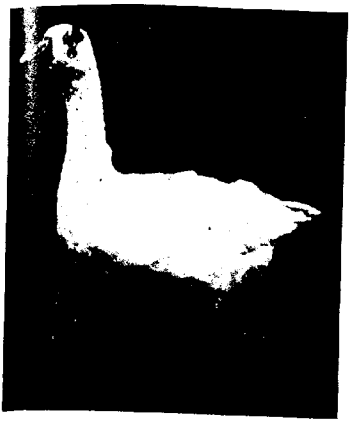
Tegetmeier states that when crossed with Embden geese the Italian breed produces large and superior table birds. A bird which won a first prize at Birmingham in 1892 was of the Italian-Embden cross and weighed 24 lb., while in the following year the same breeder showed two birds of the same cross weighing 21 lb. each, alive.

The chief advantages of Italian geese may be summed up as follows:—They are prolific egg-layers; they come early to maturity; the young birds are easy to rear; they are very fleshy and light in bone; while the meat is not in any way inferior to that of other breeds.

A complaint often made against the goose in general is that it is too large for ordinary households, and for this reason the introduction of Italian geese into this country would tend to re-establish the former popularity of the goose by providing birds of a size more suited to average modern requirements.

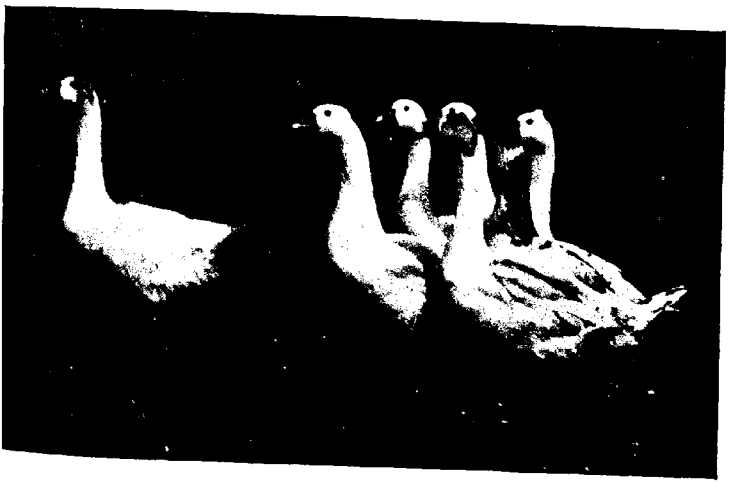
Notes on Feeding Stuffs in November: *From the Animal Nutrition Institute, Cambridge University.*

THE winter feeding season begins in earnest this month and it therefore seems desirable to introduce into these notes certain new features. The usual table of prices of the common feeding stuffs at London, Liverpool, Hull, and Bristol, will be found on p. 793, and the list of average costs per food unit arranged in order on p. 794. In addition to these two tables, which have appeared in former monthly notes, a third table (p. 797) has been prepared in which the various feeding stuffs are classified



Roman Gander.

Roman Goose.



Group of Roman Geese.

TABLE I.

Feeding Stuff.	Reckoned from digestible nutrients.		Approximate prices per ton at the end of October.				Approximate prices per Food Unit.			
	Nutritive Ratio.	Food Units.	London.	Liverpool.	Hull.	Bristol.	London.	Liverpool.	Hull.	Bristol.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
Soya Bean Cake	1 : 1·1	122·3	9 0 0	9 10 0	9 0 0	9 0 0	1 5½	1 6½	1 5½	1 5½
Decorticated Cotton Cake	1 : 1·3	126·3	9 17 6	11 10 0	—	10 5 0	1 6½	1 9½	—	1 7½
Indian Linseed Cake	1 : 1·9	123·1	11 5 0	11 3 0	—	—	1 10	1 10	—	—
English Linseed Cake	1 : 2·0	120·1	11 15 0	12 15 0	11 7 6	11 17 6	1 11½	2 1½	1 10½	1 11½
Bombay Cotton Cake	1 : 2·4	65·3	9 5 0	8 2 6	8 2 6	8 10 0	2 10	2 6	2 6	2 7½
Egyptian Cotton Cake	1 : 2·9	71·9	9 10 0	8 12 6	8 12 6	8 17 6	2 7½	2 4½	2 4½	2 5½
Coconut Cake	1 : 3·8	102·6	8 7 6	8 10 0	—	9 0 0	1 7½	1 8	—	1 9
Palm-nut Kernel Cake	1 : 4·0	83·5	8 0 0	7 0 0	7 7 6	7 10 0	1 11	1 8	1 9½	1 9½
Ground-nut Cake	1 : 0·9	145·2	*9 3 9	8 0 0	—	9 0 0	1 3½	1 1½	—	1 3
English Beans	1 : 2·6	99·5	10 0 0	11 8 8	9 13 8	10 10 6	2 0	2 3½	1 11½	2 1½
Chinese Beans	1 : 2·6	101·2	10 4 2	10 5 4	—	—	2 0½	2 0½	—	—
English Maple Peas	1 : 3·2	97·2	13 6 8	14 13 4	13 2 3	—	2 9	3 0½	2 8½	—
English Dun Peas	1 : 3·2	97·2	12 0 0	—	12 8 11	—	2 5½	—	2 6½	—
Calcutta White Peas	1 : 2·3	97·5	14 0 0	14 11 2	—	—	2 10½	2 11½	—	—
American Maize	1 : 11	93·8	9 11 4	—	—	—	2 0½	—	—	—
Argentine Maize	1 : 11	94·2	7 18 8	8 2 6	7 14 0	7 16 4	1 8½	1 8½	1 7½	1 8
Maize Meal	1 : 13	86·5	8 12 6	8 17 6	8 12 6	8 10 0	2 0	2 0½	2 0	1 11½
Maize Gluten Feed	1 : 3·3	122·6	8 2 6	—	—	8 10 0	1 4	—	—	1 4½
Maize Germ Meal	1 : 8·4	99·2	8 10 0	8 15 0	8 10 0	8 15 0	1 8½	1 9	1 8½	1 9
English Feeding Barley	1 : 7·8	83·0	11 4 0	—	11 15 2	12 0 10	2 8½	—	2 10	2 10½
English Oats	1 : 7·9	75·4	11 13 4	10 15 8	10 6 8	10 16 8	3 1	2 10½	2 9	2 10½
Argentine Oats	1 : 7·9	75·4	11 8 5	10 11 7	—	10 17 4	3 0½	2 9½	—	2 10½
Malt Culms	1 : 3·6	69·9	6 0 0	—	5 10 0	6 10 0	1 8½	—	1 6½	1 10½
Brewers' Grains (dried)	1 : 3·4	84·5	17 5 0	—	6 15 0	7 0 0	1 8½	—	1 7½	1 8
Brewers' Grains (wet)	1 : 3·4	21·1	10 18 6	—	1 5 0	—	0 10½	—	1 2½	—
Egyptian Rice Meal	1 : 10·3	78·7	8 0 0	—	—	—	2 0½	—	—	—
Burmese Rice Meal	1 : 10·3	78·7	7 0 0	7 10 0	6 10 0	7 10 0	1 9½	1 11	1 8	1 11
Wheat Middlings	1 : 5·3	93·4	8 10 0	—	7 5 0	10 5 0	1 9½	—	1 6½	2 2½
Wheat Sharps	1 : 5·3	86·3	8 8 9	9 7 6	9 5 0	9 5 0	1 11½	2 2	2 1½	2 1½
Wheat Pollards	1 : 5·3	81·9	—	7 7 6	—	—	—	1 9½	—	—
Wheat Bran	1 : 5·3	77·5	6 15 0	6 17 6	6 15 0	7 5 0	1 8½	1 9½	1 8½	1 10½
Wheat Bran (broad)	1 : 4·7	79·9	7 15 0	7 7 6	7 15 0	7 15 0	1 11½	1 10	1 11½	1 11½
Feeding Treacle	—	60·0	8 5 0	8 10 0	—	—	2 9	2 10	—	—
Linseed	1 : 5·4	153·5	15 6 11	17 5 0	16 8 6	15 9 7	2 0	2 3	2 1½	2 0½
Linseed Oil	—	250·0	28 0 0	33 0 0	26 12 6	37 6 8	2 3	2 7½	2 1½	2 11½

* 2nd grade, £8 3s. 9d. ‡ Porter grains (London), £7. † Porter grains (London), 17s.

according to their composition. This table also includes the starch equivalents of the various feeding stuffs, and shows how much linseed cake is equivalent to 100 lb. of each feeding stuff. Linseed cake has been selected as the standard because it is more familiar to the majority of stock keepers as a feeding stuff than is starch. The exact meaning of these two columns will be explained below.

Comparison of Table II. with the similar table given last month shows that feeding stuffs generally have increased in price by from 1*d.* to 3*d.* per food unit. A few feeding stuffs,

TABLE II.

Average Prices per Food Unit.

	s.	d.		s.	d.
Brewers' grains (wet) ..	1	0½	Maize meal	2	0
Ground-nut cake ..	1	2½	Beans, Chinese	2	0¼
Maize gluten feed ..	1	4¼	Maize, American ..	2	0½
Soya-bean cake	1	6	Rice meal, Egyptian ..	2	0½
Decorticated cotton cake	1	8	Beans, English	2	1
Brewers' grains (dried) ..	1	8	Wheat sharps	2	1¼
Coco-nut cake	1	8¼	Linseed	2	1½
Maize, Argentine.. ..	1	8¼	Cotton cake, Egyptian	2	5¾
Malt culms	1	8½	Linseed oil	2	6
Maize germ meal ..	1	8¾	Peas, English dun ..	2	6¼
Wheat bran	1	9¼	Cotton cake, Bombay ..	2	7¼
Palm-nut kernel cake ..	1	9½	Feeding treacle	2	9½
Wheat pollards	1	9½	Barley, English feeding	2	9¾
Rice meal, Burmese ..	1	9¾	Peas, English maple ..	2	10
Linseed cake, Indian ..	1	10	Oats, English	2	10¾
Wheat middlings ..	1	10¼	,, Argentine ..	2	10¾
,, bran (broad) ..	1	11	Peas, Calcutta white ..	2	11
Linseed cake, English ..	2	0			

however, have remained at the same price as last month, or even decreased slightly. Amongst these are ground-nut cake, maize gluten feed, malt culms, decorticated cotton cake and Indian linseed cake. The largest increases in price are shown by oats and undecorticated cotton cake, the price of the latter being now almost prohibitive.

Last month some space was devoted to the explanation of the fundamental principles of nutrition. It is desirable this month to give a little further explanation in order to make clear the meaning of Table III. In this table the feeding stuffs are classified according to their richness in proteins, or flesh-formers, as expressed by their nutritive ratios. The classification also shows how much digestible fat is contained in each feeding stuff. For the first time in these notes has been introduced (column 5 of Table III.) the term "starch

equivalent." The figures in this column give the number of pounds of starch, which, when added to a maintenance ration of coarse fodder, such as roots and straw, give the same increase in live-weight as 100 lb. of the feeding stuff so added. These figures have been ascertained by feeding experiments, of which the following is a very brief outline :—

> A store ox is kept on such a ration of roots and hay or straw as will suffice to make him "hold his own," as graziers say, *i.e.*, will just prevent his losing weight. To this ration a known weight of starch is added, when it is found that the ox gains in live-weight at the rate of about 1 lb. for each 4 lb. of starch. The animal is then once more put on the maintenance diet of roots and straw. As soon as his weight is once more steady, a known weight of the feeding stuff under experiment is added to his ration, and the increase in live-weight produced by this addition is found. In the case of experiments with linseed cake it was found that to produce 1 lb. of live-weight increase about 5 lb. of linseed cake were required. Thus, for production of live-weight increase, 5 lb. of linseed cake are equivalent to 4 lb. of starch, or 100 lb. of linseed cake are equivalent to about 80 lb. of starch, and the starch equivalent of linseed cake is therefore about 80.

When described in this way such experiments seem delightfully simple, but, as a matter of fact, so many precautions are necessary to ensure their accuracy that they can only be carried out with extreme difficulty. Numbers of them have been carried out with the greatest possible care, with the results given in column 5 of Table III. *These figures are not theoretical figures arrived at by calculation, but, as explained above, are the result of direct experiments* in which the increases in live-weight produced by the various feeding stuffs were measured with every possible precaution to ensure accuracy. They are the most reliable measure of the productive capacity of the different feeding stuffs, at any rate for producing increase in live-weight, and probably, too, for producing both work and milk. It may be asked why it is not recommended that feeding stuffs should be bought on their starch equivalents. The reason is that in buying feeding stuffs for the farm their varying manurial values must not be lost sight of. The food-unit method allows for manurial value. In the starch equivalent figures manurial value is ignored. *Therefore, farmers should buy on food units, but feed according to starch equivalents.*

Farmers may have some difficulty in grasping this idea of starch equivalents because they are not familiar with starch as a feeding stuff. Although starch in the pure form is not used in ordinary practice, it may be noted that the cereal

grains, wheat, barley, oats, maize and rice, contain about half their weight of starch, beans and peas nearly as much, and potatoes about 20 per cent. Starch is, therefore, one of the most abundant constituents of foods. To make the point clearer, however, we have calculated from the starch equivalents column 6, which shows the weights of linseed cake which may be expected to give the same increase in live-weight as 100 lb. of each feeding stuff. Here the following proviso must be made. When it is stated that 100 lb. of beans are likely to produce as much increase in live-weight as 88 lb. of linseed cake, no more is implied than is said. It is not implied, for instance, that 100 lb. of beans are equal in all respects to 88 lb. of linseed cake. Every one familiar with the general properties of these two feeding stuffs knows that they are not equal in all respects. Linseed cake, for instance, contains enough linseed oil to make it have a relaxing effect on the bowels. Beans are, on the contrary, inclined to cause constipation. In order that a feeding stuff may realise, in practice, the full value indicated by its L. C. (linseed cake) equivalent, we must be so familiar with its general properties as to enable us to use it to the best advantage. For instance, we should not get the full value out of such a reliable food as linseed cake if we used it for young stock on soppy aftermath. Although the starch equivalent of cotton cake is only 40, and its L. C. equivalent only 53, it would give a better return than linseed cake under these conditions, because its astringency would counterbalance the sloppiness of the aftermath.

Summing up the above remarks it may be concluded that, provided we are sufficiently familiar with the general properties of the feeding stuffs when used in actual practice to enable us to use them to the best advantage, the starch or linseed cake equivalents give us a good measure of their relative feeding value.

To use the information contained in Table III. the procedure is as follows:—We know that a mixture of equal quantities of linseed cake and cotton cake is a safe concentrated food for supplementing a diet of roots and straw for fattening bullocks, and that the daily ration of this mixture for animals weighing about 900 lb. live-weight is an average during the period of fattening of about 7 lb. per head. Now linseed cake and cotton cake both have nutritive ratios of about 1 : 2, and the mixture of them contains about 7 per cent. of oil. It is desired to replace this mixture by an equivalent

amount of cheaper foods. The cheapest food in the linseed cake class is ground-nut cake. Ground-nut cake, however, contains too much protein to be used by itself, so it must be mixed with something having a wider nutritive ratio. Since it is not very rich in oil, it will be best to mix it with something not very poor in oil; suitable substances are maize, dried grains, rice meal, or some kind of wheat offal, and of

TABLE III.

(1) Name of Feeding Stuff.	(2) Nutritive Ratio.	(3) Per cent. digestible. Protein.	(4) Per cent. digestible. Fat.	(5) Starch equiv. per 100 lb.	(6) Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.					
Ground-nut cake	1 : 0·9	45·2	6·3	77·5	102
Soya-bean cake	1 : 1·1	34·0	6·5	66·7	88
Decort. Cotton cake	1 : 1·3	34·0	8·5	71·0	93
Linseed cake, Indian	1 : 1·9	27·8	9·3	77·1	101
Linseed cake, English	1 : 2·0	26·7	9·3	76·0	100
Cotton cake, Egyptian	1 : 2·0	15·5	5·3	40·0	53
Cotton cake, Bombay	1 : 2·4	13·1	4·4	37·6	49
Maize gluten feed	1 : 3·3	20·4	8·8	87·4	115
Brewers' grains, dried	1 : 3·4	14·1	6·6	50·3	66
Coco-nut cake	1 : 3·8	16·3	8·2	76·5	101
Palm nut kernel cake	1 : 4·0	12·5	7·7	63·0	83
Linseed	1 : 5·4	18·1	34·7	119·2	157
Fairly Rich in Protein, Rich in Oil.					
Maize germ meal	1 : 8·4	9·0	6·2	81·0	107
Rice meal	1 : 10·3	6·8	10·2	68·4	90
Rich in Protein, Poor in Oil.					
Peas, Calcutta, white	1 : 2·3	23·3	1·1	66·9	88
Beans, English	1 : 2·6	19·3	1·2	67·0	88
Beans, Chinese	1 : 2·6	19·6	1·7	67·0	88
Peas, English maple	1 : 3·2	17·0	1·0	70·0	92
Brewers' grains, wet	1 : 3·4	3·5	1·5	12·7	17
Malt culms	1 : 3·6	11·4	1·1	38·7	51
Cereals, Rich in Starch, not Rich in Protein or Oil.					
Barley, feeding	1 : 7·8	8·0	2·1	67·9	89
Oats, English	1 : 7·9	7·2	4·0	59·7	79
Oats, Argentine	1 : 7·9	7·2	4·0	59·7	79
Maize, American	1 : 11·0	6·7	4·5	81·0	107
Maize, Argentine	1 : 11·0	6·8	4·5	83·5	110
Maize meal	1 : 13·0	5·5	3·5	77·8	102
Wheat middlings	1 : 5·3	12·0	3·0	59·1	78
Wheat sharps	1 : 5·0	12·0	4·0	58·4	77
Wheat pollards	1 : 5·0	11·6	3·5	54·1	71
Wheat bran	1 : 5·0	11·3	3·0	49·7	65
Wheat bran broad	1 : 4·7	11·3	3·0	48·1	63

these maize and dried grains are the cheapest. A mixture of ground-nut cake and dried grains would have a nutritive ratio of about 1 : 2, and would contain about 6½ per cent. of oil. It would thus have almost exactly the same composition as the mixture of linseed cake and cotton cake. The column of L. C. equivalents shows that ground-nut cake is equal for fat production to rather more than its own weight of

linseed cake. Dried grains are equal to only 66 per cent., or two-thirds of their weight of linseed cake, and cotton cake to only half its own weight of linseed cake. To get the equivalent of 7 lb. of mixed linseed and cotton cakes we must use about 3¼ lb. of ground-nut cake mixed with about 2¼ lb. of dried grains. Such a mixture should have about the same value for producing fattening increase as 7 lb. of mixed linseed and cotton cakes, provided that ground-nut cake turns out to be a healthy food when used under these conditions.

If it is decided to replace the standard mixture by ground-nut cake and maize, we must use more cake than maize, or we shall not get enough protein. About 4 lb. of ground-nut cake mixed with 2 lb. of maize will have rather a wider nutritive ratio than the standard mixture, but will still supply enough protein for full-grown bullocks; it will contain about 5 per cent. of oil; and since ground-nut cake and maize are each equal to rather more than their own weight of linseed cake for the production of fattening increase, about 5 lb. of the mixture will be equivalent to 7 lb. of mixed linseed and cotton cakes.

These two instances illustrate the use of the table. The columns giving nutritive ratio and oil show us in what *proportions* to mix foods so that the mixture may have the same composition as the food we wish to replace, and the L. C. equivalents show us *how much* of the mixture will be equivalent to the weight of food we are replacing. It is wasteful to replace cotton cake by an equal weight of maize, for the L. C. equivalents of these foods show that 1 lb. of maize is equivalent for fat production to 2 lb. of cotton cake. *Unless we allow for such facts in rearranging diets we shall not get the full economic advantage of using cheaper mixtures.*

Suggested Rations for November.—Rations may now be suggested in the light of what has been said above.

For Horses at Farm Work.—Experience has shown that horses of average size work well in the winter, and keep in good condition on ordinary allowances of hay or straw, or a mixture of the two, in addition to a weekly allowance of 2 bush. per head of oats, or 12 lb. per head on working days, and 6 lb. on Sunday. At present prices oats may be replaced with very great economy by either of the following mixtures:—

I.		II.	
Crushed maize ..	2 parts.	Crushed maize ..	2 parts.
Dried brewers' grains	2 „	„ beans ..	1 part.
Rice meal (rich in fat)	1 part.	Bran	2 parts.

These mixtures have about the same composition as oats, and give good results with working horses in practice. Reference to their L. C. equivalents, however, shows that they are about one-tenth higher in feeding value than oats, so that about 11 lb. per head per day should be used to replace 12 lb. of oats.

For Breeding Mares and Weaned Foals.—It is doubtful economy to dispense entirely with oats for such important animals. For rations see last month's notes.

For Milch Cows.—The following ration is recognised as suitable for a cow of about 1,100 lb. live-weight giving about 2 gal. of milk a day.

Roots ..	56 lb.	Bran	3 lb.	= 5 lb. concentrated food.	
Hay ..	8 „	+	Linseed cake	1 „	
Straw ..	12 „		Undecorticated cotton cake	1 „	

It is also recognised that it is necessary to give about 2 lb. extra of the concentrated food mixture for each extra gallon of milk. Though quite suitable, this mixture is expensive at present prices. Bran is rising in price every month; linseed cake is dear; and the present price of undecorticated cotton cake is almost prohibitive.

The following mixtures have about the same composition as the mixture of bran, linseed cake, and undecorticated cotton cake, recommended above:—

I. Maize gluten feed .. 1 part.	II. Decorticated cotton cake .. .. 3 parts.
Dried brewers' grains 1 „	Crushed maize .. 2 „
Coco-nut cake .. 1 „	

III. Malt culms .. .. 2 parts.
Coco-nut cake .. 1 part.
Rice meal .. .. 1 „

I. and II. are about one-third higher in feeding value than the standard mixture, and III. is about equivalent to the standard mixture. The rations, therefore, are as follows:—Of mixtures I. and II., 4 lb. per head per day, with 1½ lb. extra for each extra gallon of milk. Of Mixture III., 5 lb. per head per day, with 2 lb. extra for each extra gallon of milk.

For Fattening Bullocks.—The following is a typical ration for a bullock of 900 lb. live-weight when starting to fatten in the winter:—

Roots .. .. .. 84 lb.
Hay and straw .. .. 8–10 „
Linseed cake and undecorticated cotton cake, 4 lb., rising to 10 lb., averaging 7 lb.

On such a ration bullocks will fatten in about 16 weeks; its only fault is the very high price of the cake.

The root crop is good in many districts this year, and where roots are plentiful the most economical plan will be to approach as near as may be to the old-fashioned ration of plenty of roots, straw, and time, which used to be considered capable of fattening any bullock. It will, however, be best to use some cake in addition, for, as was shown last month, roots and straw are not rich enough in protein to form the whole of a fattening diet. They provide plenty of carbohydrates, and plenty of bulk to fill the animals, but for the best results more protein and oil are desirable. The cheapest source of protein and oil at present prices is ground-nut cake, which may be used at the rate of 3 lb. per head per day, rising to 5 lb. With all the roots and straw the animals will eat, this allowance of ground-nut cake will make a well-balanced diet. It may be advisable to top up with 2 lb. of linseed cake in addition for the last fortnight.

If the root crop is short, and the animals can only be allowed something like 56 lb. per head per day, or if, as is sometimes the case, the animals will not eat more than 56 lb., more concentrated food must be provided. Ground-nut cake alone is under these circumstances too rich in protein to be used in large quantities. The following are worthy of trial :—

I. Palm-nut kernel cake.
II. Ground-nut cake and maize meal, half and half.
III. Decorticated cotton cake and crushed maize, half and half.

These are about right as regards nutritive ratio for use with a small ration of roots, such as is mentioned above. Their feeding values, however, differ considerably. Palm-nut kernel cake should be used at the rate of 4 lb. per head per day, rising to 8 lb. The ration for II. or III. will be 3 lb., rising to 7 lb. In the case of all these foods it is advisable to begin for the first few days with small quantities until the animals get used to them, when they may be gradually increased up to the suggested rations. Where possible it will probably pay to finish during the last fortnight with 2 lb. per head per day of linseed cake in addition.

For Stores intended for Grass Beef next Summer.—Such young stock on grass in the autumn require careful treatment. Filling themselves with old, more or less dead, grass they are liable to become distended, or "mawbound." This can generally be removed by a dose of linseed oil as soon as it is noticed. At the same time the wet green grass may cause scouring. For these reasons it is somewhat risky to dispense

entirely with linseed and cotton cake. Some such mixture as the following may be suggested :—

Coconut cake	2 parts.	Ration 3 to 4 lb. per head per day.
Linseed cake	1 part.	
Undecorticated cotton cake ..	1 ,,	

Further economy might be effected by using palm-nut kernel cake at the rate of 3 lb. to 4 lb. per head per day, but the writers have some diffidence in recommending this ration, as they have no personal experience of its use for this purpose.

For Stores in the Yards about 18 Months Old or over.—It is a common practice to allow stores of this description a bare maintenance diet, that is to say, just enough food to keep them from losing weight. This practice is never truly economical, for a given expenditure in food produces far more live-weight increase when eaten by young stock than when fed to adult animals. Under present conditions, when food is dear and beef makes a very high price, it is most certainly bad practice not to push on stores during the winter.

Where the root crop is short, and only a small ration of roots can be spared for the young stock, a sound ration of concentrated food to use, together with straw and a small root ration, is 2 lb. to 3 lb. per head per day of a mixture of 3 parts undecorticated cotton cake, and 1 part linseed cake. At present prices this ration would be very expensive. It may be economically replaced by some such mixture as the following :—Ground-nut cake and rice meal, half-and-half ; or decorticated cotton cake and rice meal, half-and-half. Reference to Table III. will show that these mixtures are considerably higher in feeding value than cotton cake and linseed cake ; they should, therefore, be used in smaller quantities. A suitable ration is 1½ lb. to 2½ lb. per per head per day according to age and condition.

Where the root crop is plentiful, young stock should get a full ration of roots and straw, supplemented with 1½ lb. to 2 lb. per head per day of ground-nut cake.

In districts where hay is plentiful, and can be spared for the young stock, with little or no roots, a less nitrogenous concentrated food may be used. Young stock will keep healthy, and make good progress on a hay diet supplemented with 2 lb. to 3 lb. per head per day of any of the following feeding stuffs :—Palm-nut kernel cake, rice meal, coconut cake, or dried grains.

For Calves or Young Stores 6 to 12 Months Old.—The remarks about the economy of pushing on young stock apply with

still more force to calves. To keep such young stock thriving it is advisable to spare them some hay for the bulky portion of their diet. The basis of their concentrated ration should be 5 parts of maize ground together with 1 part of linseed. In these proportions maize and linseed grind well together, and make a wholesome mellow food, which is an economical substitute for linseed cake at present prices.

Where hay is the basis of the diet the following concentrated ration will be found suitable and economical :—

Calves 6 months old : ¾ lb. per head per day of the maize-linseed mixture, together with ¾ lb. of bran, dried grains, or malt culms ; this ration to be gradually increased to double by the end of the winter. For older calves the ration should be increased according to age up to 3 lb. or 4 lb. per head per day.

Where no hay can be spared, and the basis of the diet is straw and a small ration of roots, the ration of concentrated food should be 2 lb. per head per day of the maize-linseed mixture for 6-month-old calves, rising to double by the end of the winter.

If it is possible to give a full ration of roots a better concentrated ration will be 1 lb. per head per day of the maize-linseed mixture, and 1 lb. of decorticated cotton cake or ground-nut cake. As before, this ration should be doubled by the end of the winter.

For Young Calves.—It is not possible here to give full directions for calf rearing, which is dealt with in an article at p. 768, and in Leaflets issued by the Board.

For Sheep Fattening on Roots.—Where plenty of roots are available of such quality that the sheep will eat a full ration, together with the usual allowance of hay or straw chaff, the following mixtures of concentrated foods are suitable and economical at present prices :—

I.		II.	
Decorticated cotton cake	1 part.	Decorticated cotton cake	1 part.
Crushed maize ..	2 parts.	Dried grains ..	3 parts.
III.			
Ground nut cake ..	1 part.		
Crushed maize ..	3 parts.		

Mixtures I. and III. should begin at ½ lb., rising gradually to 1 lb. per head per day. Mixture II. has a lower feeding value, so that a higher ration is necessary ; the equivalent ration will be 10 oz., rising to 1¼ lb. per head per day.

Where the roots are not plentiful, or where they are dry, or tough, so that the sheep will not eat a full ration, it is

advisable, even at present prices, to include a little linseed cake in the concentrated mixture. The following mixtures and rations are suggested :—

I. Linseed cake.. .. 1 part.	II. Linseed cake .. 1 part.
Decorticated cotton cake .. .. 1 „	Decorticated cotton cake .. .. 1 „
Crushed maize .. 6 parts.	Dried grains .. 7 parts.

III. Linseed cake .. 1 part.
Ground-nut cake .. 1 „
Crushed maize .. 6 parts.

Suitable rations of I. and III. are ¾ lb., rising to 1¼ lb. per head per day. Mixture II. should be used in rather larger quantities—1 lb., rising to 1½ lb. per head per day.

These rations supply considerably less protein than many sheep feeders are accustomed to use, but our experience shows that sheep will fatten well on such rations, and that fewer unexplained deaths will occur than are usual on rations higher in protein.

For Ewes Heavy in Lamb, on Roots or Grass.—A safe and economical ration of concentrated food is 4 oz. to 6 oz. per head per day of bran or dried grains, together with the usual straw and hay "chop."

For Fattening Pigs.—The following mixtures are efficient substitutes for barley meal, which at present prices is out of the question for profitable pig feeding :—

I. Sharps and maize meal, half and half.
II. Maize germ meal and rice meal, half and half.

Rice meal for pig feeding need not be rich in oil, but care should be taken that it is not simply ground rice husks, which have little value for fattening. It is wise to buy rice meal on the basis of its analysis.

Home Production of Food.

THE Final Report of the Departmental Committee on the Home Production of Food has been published.* It will be remembered that in their Interim Report† (see *Journal*, September, 1915, page 585) the Committee recommended that a minimum price for wheat should be guaranteed by the State for a period of 4 years. The Government having decided not to adopt this recommendation, the Committee have considered in the Majority Report, which is signed by seven out of the nine members, by what other means the production of food in England and Wales might be increased during the war.

* Final Report [Cd. 8095], price 1½*d.*
† Interim Report [Cd. 8048], price 1*d.*

The Committee are convinced that there is great need to increase the productivity of the soil of this country, which, as they believe, falls far short of what it might be, by stimulating more intensive cultivation and by bringing under the plough a large area of land at present wastefully devoted to inferior pasture. Any increased production of food must rest upon a greater output from the soil, and from all the evidence laid before them, the Committee concluded that, speaking generally, the land of England is being kept at a comparatively low level of cultivation, and that it might be made to produce a greater amount of food without the withdrawal of labour from more profitable industries. In particular, the conversion of arable land into grass, which has taken place to the extent of nearly 4,000,000 acres during the last 40 years and is still going on, must necessarily be attended by a diminution in the amount of food produced. Evidence was received that a great deal of this land would produce twice as much meat and milk when under the plough as when in permanent grass, and that more, and not less, stock could be maintained on it if it were restored to arable cultivation, while it would also be producing corn for human consumption.

It is pointed out that the conversion of a considerable area of grass land into arable, bringing with it, as the Committee believe it must, a great increase in food supply, will be in the permanent interest of the nation. The intensification of British agriculture will be even more necessary after the war than now, for then the nation's indebtedness will have reduced its purchasing power abroad, and the need will be felt for the extra employment of labour that arable land provides. Moreover, at all times, a State purchasing the greater part of its food from foreign sources is *ipso facto* more open to attack and in a more unstable economic position when war comes. The Committee, therefore, hope that the importance of bringing poorer pastures under arable cultivation will be recognised by the Government and the agricultural community. In their opinion, it is only on these lines that a substantial increase in the home production of food can be achieved.

With a view to increase the supplies of fertilisers the Committee recommend that the Government should arrange with those who control the home-production of sulphate of ammonia for a sufficient supply to be available for farmers at as near pre-war prices as possible, using, if necessary, their

powers to restrict exports for the purpose. It is also suggested that shipping arrangements should be made for the importation at reduced rates of Florida and Tennessee phosphate rock, and of Chilian nitrate of soda, and that steps be taken to assist superphosphate makers to speed up their sulphuric acid producing plants.

The Committee recommend that immediate steps be taken to stimulate the breeding of pigs, and they suggest the formation of local societies through which loans of sows could be made to cottagers and small farmers.

In order to maintain, still more to increase, the agricultural output in England and Wales, it will be necessary to relieve the existing shortage of agricultural labour. The Committee recommend that steps should be taken (i) to retain skilled workers on the farms; (ii) to improve the organisation of women's labour; and (iii) to release soldiers in this country for farm work at time of pressure. They also recommend that the Government should assist the makers of agricultural machines of proved efficiency, particularly of motor tractors and ploughs, to increase their present output. It is further suggested that, in order to bring waste land in the neighbourhood of towns and villages under cultivation, local authorities should be enabled to take over such land at an agricultural rent. Landowners are urged to review the use made of their moorlands, with the object of seeing that they are grazed with as many sheep as they can carry, and to see that parks are used to their maximum capacity for grazing stock.

Six members of the Committee, namely, Lord Milner (the Chairman), Mr. E. G. Strutt, Mr. C. W. Fielding, Mr. A. D. Hall, Mr. Rowland E. Prothero, M.P., and Mr. J. A. Seddon add a note expressing the opinion that "it is necessary and practicable to produce within this country a very large proportion of the foodstuffs and other agricultural products natural to its soil, but now purchased abroad at a cost of nearly £300,000,000 per annum, two-thirds of which are derived from countries outside the British Empire." They believe that this can be done to the physical, social, and economic advantage of the country.

Mr. F. D. Acland, Mr. Fielding, and Mr. Hall urge, in a separate memorandum, the organisation of educational methods so as to effect an improvement in production. Their colleagues, while not differing from these proposals, thought them of too detailed a character for inclusion in the Report. Mr. Acland also recommends steps to be taken with the object of reducing the number of rabbits, game, and foxes.

A Minority Report is signed by Lord Inchcape and Sir Harry Verney explaining the reasons which prevent them from adhering to the main Report. They state that the recommendations contained in the latter are intended to apply to conditions after the war, with which the Committee were not invited to deal. They expressly abstain from adhering to the opinion that the nation's purchasing power will hereafter be reduced, or that it is necessary and possible to raise in this country a very large proportion of nearly £300,000,000 worth of food now purchased abroad.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

SOILS AND MANURES.

Manganese and Radio-Active Manure (*Die Landw. Versuchs-Stat., Band lxxxvii, Heft* 1 ; *B. Schulze, Breslau*). Pot experiments on sugar beet showed that manganese nitrate, phosphate, sulphate, and a mixture of the hydroxide and carbonate all increased the yield of roots. Averaging the yields from the different sized dressings given, the best results were obtained from the phosphate and a mixture of the sulphate with aluminium sulphate, although the highest yield of the whole experiment was given by the smallest quantity of the nitrate tried (*i.e.*, such that ·006 per cent. of the contents of the pots consisted of manganese).

A radio-active manure supplied by the Banque du Radium produced increased yields of oats and mustard.

It was concluded that the action of the manganese and radio-active substance was that of stimulants.

Radium as Manure (*Science* [*U.S.A.*] 14th May, 1915).—The University of Illinois Agricultural Experiment Station carried out experiments in 1913 and 1914 with radium salts furnished by the Standard Chemical Company of Pittsburgh, these salts being used in amounts so as to supply ·01 milligram, ·1 milligram, and 1 milligram of radium per acre ; such small amounts were applied in order to avoid any appreciable effect from the salts other than that due to radio-activity.

From the two years' work, six trustworthy results were obtained with a maize crop, three "for" and three "against" radium ; and eighteen trustworthy results with soya beans, nine "for" and nine "against" radium.

The conclusion is reached that "radium, with all its wonderful energy, is found upon careful analysis of the known facts, to afford no foundation for reasonable expectations of increased crop yields, when financial possibilities are considered . . . the heat evolved by 1,000 dollars worth of radium on an acre of land in 100 days [the period of good crop growing weather] would be less than the heat received from the sun on one square foot in 30 seconds."

* A summary of reports on agricultural experiments and investigations recently received is given regularly. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Sterilisation of Soil (*Ohio Agric. Expt. Sta. Circ. No.* 151).—It has become clear in Ohio that some method of soil sterilisation must be used to check the accumulation of disease organisms in greenhouses used for continuous cropping and in plant beds or cold frames used for growing seedling plants for outdoor use.

Originally the perforated pipe method of steaming was most largely used but has been replaced in the Cleveland district by the inverted pan method. In the pipe method perforated pipes are buried in the soil, the surface being covered with canvas or other covering and steam passed into the pipes at high pressure for such a period as is required to heat the soil to the necessary temperature. In the inverted pan method the apparatus consists of a galvanised iron pan with sharp edges which are forced into the soil on all sides so as to prevent the escape of the steam when the latter is admitted under pressure. With either method the steaming is carried on long enough to heat and sterilise the soil, at least one hour being required.

Formalin has proved effective but more expensive than the above methods.

FIELD CROPS.

Varieties of Wheat (*Univ. of Leeds and Yorks. Co. for Agric. Educ., Rept. No.* 97; *J. Potts, B.Sc., N.D.D.*).—Wheat followed oats after swedes (half-consumed on land), on a medium loam. The seed was pickled with bluestone and drilled at the rate of 3 bush. per acre on 24th October, 1914. A wet autumn and winter, a cold, dry spring, an unsettled summer and a fine September were experienced. During December and January the wheat was eaten close to the ground by rabbits; in early May it was noticed that hares showed a preference for Iron and Extra Squarehead II., two of the Swedish varieties. On 15th April the plots were dressed with 1 cwt. nitrate of soda and 1 cwt. salt. The yields per acre in 1915, the average yields from 1912–15, and the total value (grain and straw) per acre in 1915 on the basis of the estimated monetary returns are as follows:—

	Yield, 1915.		Value, 1915.			Average Yield, 1912–15.	
	Grain.	Straw.				Grain.	Straw.
	Bush.	Cwt.	£	s.	d.	Bush.	Cwt.
Garton's Benefactor ...	36¾	24	12	4	2	—	—
Garton's Victor	36½	23½	11	13	0	45¾	31¼
Iron (Svalöf)	36¼	27½	11	6	8	—	—
Grenadier (Svalöf) ...	34	26	10	16	10	—	—
Sun (Svalöf)	33½	23¾	10	11	9	41½	30¼
Little Joss	33¼	27	10	14	0	43½	33¾
Carter's White Standup...	33¼	23½	10	18	7	41	30¼
Webb's Standard Red ...	32	25¼	10	5	1	41½	32
Squarehead's Master ...	31½	24¾	10	5	5	41½	33½
Browick Grey Chaff ...	30	26	9	18	0	40¾	33
Extra Squarehead II. (Svalöf)	27¾	22½	8	16	7	40	33¼

Benefactor is a white wheat recently introduced by Messrs. Garton's. It has been grown only once at Garforth, when both yield and quality of grain were excellent. The ear is very broad and compact, while the glumes are covered with hairs; it seems not unlikely that the ears

would hold water in a wet harvest, and that the grain would quickly sprout in the stook in wet weather.

Grenadier, Sun, Iron and Squarehead II., introduced from Svalöf, are red-grained white-chaffed wheats with very strong straw; Grenadier is recommended for soils on which wheat is apt to lodge. At Garforth, Sun has always given grain of excellent quality, but the yield of straw has not been high. Iron ripens a few days later than the varieties usually grown in England. Squarehead II. is recommended for the stronger and better soils.

Varieties of Wheat (*E. Suffolk Educ. Com.*).—Seven varieties were grown in 1915 at five centres on soils of a fairly heavy type. The average yields of wheat in bush. per acre were as follows:—Victor, 41¼; Brooker's Double Standup, 41; Little Joss, 40¾; Wilhelmina, 40½; Swedish Squarehead II., 38¾; Squarehead's Master, 38½; Swedish Grenadier III., 38. Squarehead's Master and Little Joss were of very good quality, Wilhelmina, Victor, Brooker's Double Standup and Swedish Extra Squarehead II. were of medium quality, while Swedish Grenadier III. was poor.

The Swedish wheats are especially suited for very rich land, or to conditions where there is a probability that other kinds will be laid. Swedish Squarehead II. is especially strong in the straw.

Varieties of Winter Oats (*Univ. of Leeds and Yorks. Co. for Agric. Educ., Rept. No. 97; J. Potts, B.Sc., N.D.D.*).—The oats followed "seeds" grazed, after barley, after oats, the soil being a medium loam; 4 bush. of seed per acre were drilled in on 1st October, 1914; ¾ cwt. nitrate of soda and 1 cwt. salt per acre were applied on 17th April. The yields per acre were as follows: Black Winter Oat (seed from Woodhead and Sons, Leeds), 46¼ bush. grain, 22¼ cwt. straw; Garton's Prolific Dun Oat, 44½ bush. grain, 25 cwt. straw; Webb's Black Winter Oat, 44 bush. grain, 23¼ cwt. straw; Garton's Bountiful, 31½ bush. grain, 19¾ cwt. straw.

Webb's Black Winter Oat was the best sample, being the best in colour and the most evenly grown; the Black Winter Oat (Woodhead's seed) was not of such good colour and contained more imperfectly developed grains. Dun Oat is not a good selling oat owing to its grey or dun colour; it was very evenly grown, but not so plump in the grain as the black oats; however, it appeared to be thin skinned, and there were hardly any empty husks. Bountiful contained a large proportion of badly-developed grains.

POULTRY.

Final Results of the Ten Months' Laying Competition of the Harper Adams Agricultural College and the Utility Poultry Club.—This competition finished on 30th August last, having continued for 10 calendar months, or a total of 304 days. The average results per bird compare very favourably with those obtained in the two preceding competitions lasting for the full 12 months, as will be seen from the following records:—

	Average per bird.	
	Eggs.	Value. s. d.
1912–13 (12 months)	152	14 5
1913–14 (12 „)	187	19 0
1914–15 (10 „)	169	17 4

The results in the different breed sections were as follows :—

	Average per bird.	
	Eggs.	Value. s. d.
Section I.—(Leghorns)	176	17 7
„ II.—(Wyandottes)	167	17 5
„ III.—(Buff Orpingtons, Barred Rocks and Rhode Island Reds) ..	165	17 2
„ IV.—(Sussex and Faverolles)	155	16 0

The largest number of eggs laid per pen, viz., 1,302 (valued at £6 18*s.* 4*d.*) came from a pen of Leghorns, this pen including the best layer (253 eggs) of the whole competition. No less than 24 birds in the Leghorn section laid over 200 eggs in the 304 days.

The Wyandottes section included the winning pen, laying 1,272 eggs valued at £7.

The best pen in Section III. was one of Barred Rocks, which laid a total of 1,157 eggs valued at £6 1*s.* 7*d.*

In Section IV. (containing 6 pens) 2 pens succeeded in laying over 1,000 eggs.

OFFICIAL NOTICES AND CIRCULARS.

Agriculture and Recruiting.

1. THE President of the Board of Agriculture and Fisheries is receiving a large number of enquiries from farmers and other agriculturists as to the effect on agriculture of Lord Derby's recruiting scheme, and the following statement has been prepared in answer to such enquiries :—

2. Certain classes of skilled agricultural workers have been starred in connection with the National Register. These will in no case be enlisted for immediate service with the Colours, even if they offer themselves for that purpose, but they can if they wish be attested, passed at once into Section B Army Reserve, grouped, and returned to their civil occupations. A man accepted on these conditions will be entitled as a soldier in the Reserve to wear a khaki armlet, which will be given to him by the Military Authorities. Men will be grouped in the Reserve in 46 classes according to their age and condition, *i.e.*, married or single, and the groups will be called up for service in order. Starred men will not be called up for service unless the Recruiting Officer appeals to the local tribunal appointed by the District Council on the ground that a particular man is improperly or unnecessarily starred. In such a case the local tribunal will investigate the case and report to the Central Appeal Committee, who will decide whether the man should be called up for service or not.

3. If any starred man has inadvertently been enlisted for immediate service with the Colours, the employer at once should notify the Secretary of the County War Agricultural Committee, and write to the War Office, who have undertaken to make every effort to return him to civil occupation.

4. In addition to the starred men there are the cases of certain men who have not been starred owing to mis-description or other causes. If such a man offers himself for enlistment the employer will have the right of appeal to the local tribunal and if it is decided that the man ought to have been starred he will be placed in the same position as a starred man.

5. There are also certain men who though not belonging to the starred classes are really indispensable on the farms or in the trades allied to agriculture. The farmer who manages a farm heads this list. If men who are really indispensable from the national point of view for the cultivation of the land feel impelled to offer themselves for military service, Lord Selborne strongly advises them not to enlist for immediate service, but to exercise their option of being attested and passed into the Reserve. This will ensure their present continuance in their civil occupation, and on each occasion that their group is called up an opportunity will be given through the local tribunals for consideration whether on national grounds their service should not be postponed to a later date.

6. The above arrangement should ensure that farmers and other agricultural employers shall keep their properly starred men, and that in the doubtful cases they shall not be denuded of labour without being afforded an opportunity of having those cases considered, and it will give them some time to engage and train women or other substitutes.

7. Farmers themselves, in common with other employers, have not been starred, but it is essential that at least one member of the farmer's family should remain to direct the business. Lord Selborne considers that farmers of military age who desire to join the Army should not enlist for immediate service, but be attested and passed into the Reserve.

8. Lord Selborne feels sure in view of the arrangements made for the retention of the skilled and indispensable men that farmers and other agricultural employers will encourage the immediate enlistment of men who are not really indispensable.

Autumn Dressings for Wheat.

THE Board of Agriculture and Fisheries wish to impress upon farmers the desirability of top-dressing wheat on soils of poor or medium quality with from ¾ to 1 cwt. of sulphate of ammonia per acre during November or December.

A leaflet explaining the reasons for this recommendation, containing suggestions for the manuring of different soils, will be sent, post free, on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

In order to encourage the use of top-dressings the President of the Board of Agriculture and Fisheries, with the concurrence of the Secretary for Scotland, has come to an agreement with manufacturers of sulphate of ammonia in Great Britain who have agreed to reserve a definite proportion of their make in November and December for farmers' use. Under this arrangement farmers or agricultural merchants will be able to purchase sulphate of ammonia from the manufacturers for prompt cash, at not more than £14 10s. per ton, single bags free, free on rail at

works, net cash, in lots of not less than 10 cwt. each. This price relates to sulphate of ammonia containing 20·16 per cent. of nitrogen (= 24·5 per cent. of ammonia). Purchases made from merchants or agents, or upon other terms than those stated, must be at such price as may be agreed.

Farmers who desire to take advantage of these terms should place their orders with the manufacturers *early*, or they may find that the supply which has been reserved under this arrangement has been exhausted.

If a farmer or merchant finds himself unable to obtain supplies on the above terms, he should at once communicate with the Secretary to the Fertilisers Committee, 3, St. James's Square, London, S.W.

Transport of Goods by Rail.

In view of the difficulties and delays which are liable to arise under present conditions in the transport of goods by rail, the Board of Agriculture and Fisheries recommend farmers to place their orders for feeding stuffs and other farm requirements so as to allow ample time for delivery.

Railway Companies are contending with great difficulties owing to the exceptional demands upon their rolling stocks, while prompt delivery by manufacturers is in many cases hampered by a shortage of labour. By placing their orders so as to allow ample time for delivery farmers will avoid inconvenience to themselves and will assist both the Railway Companies and the manufacturers.

Apple Pomace as a Feeding Stuff.

The Board of Agriculture and Fisheries wish to draw the attention of stock keepers living in cider-making counties to the value of pressed apple pomace as a palatable feeding stuff for all kinds of stock. The fresh pomace, which contains from 70 per cent. to 80 per cent. of water, according to the efficiency of the pressing and the variety of apple, should be fed in combination with more concentrated feeding stuffs, and not as a complete ration in itself. On the basis of composition it has a considerably higher feeding value than mangolds, and is not unlike wet brewers' grains, though it contains less protein. As it ferments rapidly it should be fed quite fresh; or it may be preserved with salt and made into a kind of silage. When dried the pomace forms a valuable concentrated feeding stuff.

Committee on Supplies of Fertilisers.

The President of the Board of Agriculture and Fisheries has appointed a Departmental Committee to make arrangements with a view to the maintenance, so far as possible, of adequate supplies of fertilisers for use of farmers in the United Kingdom.

The Committee is constituted as follows:—

The Right Hon. F. D. Acland, M.P., Parliamentary Secretary to the Board of Agriculture and Fisheries, (*Chairman*); Mr. R. H. Rew, C.B. (Board of Agriculture and Fisheries), Mr. T. H. Middleton, C.B. (Board of Agriculture and Fisheries,) Mr. G. J. Stanley, C.B., C.M.G. (Board of Trade), Mr. J. Dundas White, M.P. (Scottish Office), Mr. H. Ross Skinner (Ministry of Munitions), Mr. E. J. Foley (Admiralty), Mr. R. J. Thompson (Board of Agriculture and Fisheries). *Secretary:* Mr. H. D. Vigor, 3, St. James's Square, London, S.W.

Distribution of Sittings of Eggs of Pure Breeds of Poultry.

THE Board of Agriculture and Fisheries have, with the concurrence of the Treasury and the Development Commissioners, asked the Local Education Authorities in certain selected counties to co-operate with them in a Scheme for the Distribution of Sittings of Eggs of Pure Breeds of Poultry to Cottagers and Small Holders. The Scheme is as follows :—

1. The Board are prepared to encourage the establishment of a limited number of stations for the distribution of sittings of eggs of pure-bred fowls to cottagers and small holders, the assessment of whose holding or holdings does not exceed £50 in the aggregate.

2. Applications from those who are willing to establish and maintain such stations may be made to the Agricultural Organiser for the county.

3. Preference will be given to applicants who are situated in the vicinity of groups of small holdings, and who are engaged in agriculture.

Selected applicants must comply with the following conditions :—

(1) Each station-holder will be required to provide approved stock consisting of not less than 24 pure-bred hens or pullets, and one pure-bred cock or cockerel for every 12 hens or pullets ; to dispose of any other birds on the holding, and to undertake not to introduce any poultry other than the approved stock without the Agricultural Organiser's permission. Save in exceptional circumstances only one breed of fowls should be maintained.

(2) The male birds used at the station must be replaced each year by males whose breeding and stamina are likely to secure and maintain vigour and fecundity in the offspring.

(3) One-third of the hens must be replaced each year by well-matured pullets.

(4) The birds must be housed and fed as the Agricultural Organiser may direct, and must be divided into suitable flocks for breeding purposes ; they must be provided with grass runs, allowing in cases where the runs are enclosed not less than 20 sq. yd. per bird.

(5) The station-holder will be required to supply sittings of 12 eggs to cottagers and small holders resident in the county from the 1st December to the 30th April in each year at 2s. per doz., including the provision of a suitable box for packing. *Carriage on the eggs must be paid by the purchaser.*

(6) All eggs sent out from the station must be stamped with a stamp provided by the Board.

(7) Orders received for eggs should be executed in rotation, and no applicant should be permitted to obtain more than 3 sittings of eggs in the season. Infertile eggs (if they are returned carriage paid) will be replaced.

(8) The station-holder will be required to keep an accurate record of the number of eggs laid during the season, and to record the name and address of each applicant to whom sittings are supplied and the date on which the eggs were despatched. A record book will be supplied for this purpose which must be submitted to the Board through the county organiser at the close of the season.

(9) The station-holder must permit officers of the Board or of the local authority to visit the station at any time, to inspect the stock, the method of management and the record book.

(10) Provided that *at least* 60 sittings of eggs are distributed to eligible applicants during the period from the 1st December to the 30th April, the station-holder will receive a subsidy of £5 when the Board are satisfied that the conditions of the scheme have been fulfilled. If a smaller number than 60 sittings of eggs is distributed the subsidy will be reduced proportionately.

(11) In all matters of dispute the decision of the Board shall be final.

Wart Disease of Potatoes.

THE following is a list of the potatoes recommended by the Board of Agriculture and Fisheries for planting on Infected Premises and Infected Areas in England and Wales for 1916:—

1. A1 (Sutton).
2. Conquest (Findlay).
3. Snowball (Carter).
4. Abundance (Sutton).
5. King Albert (Sands).
6. Leinster Wonder (Sands).
7. The Duchess (Dobbie).
8. Rob Roy (McAlister).
9. Great Scot (McAlister).
10. Southampton Wonder (Toogood).
11. Jennie Deans (Findlay).
12. Kerr's Pink.
13. Schoolmaster.
14. Crofter (Dobbie).
15. Culdees Castle (G. R. Sharp).
16. Provost (Dobbie).
17. The Admiral (Dobbie).
18. Irish Queen (Sands).
19. Shamrock (Sands).
20. St. Malo Kidney.
21. King George V. (Butler).
22. Laird (Davis).
23. Flourball (Sutton).
24. Golden Wonder (Brown).
25. Langworthy (Niven).
26. What's Wanted (Niven).
27. Burnhouse Beauty (Dobbie).
28. The Lochar (Farish).
29. White City (Sutton).

Employment on the Land of Sailors and Soldiers on Discharge from the Navy and Army.

THE Departmental Committee appointed by Lord Selborne under the chairmanship of Sir Harry Verney, Bart., M.P., to consider what steps can be taken to promote the settlement or employment on the land in England and Wales of sailors and soldiers, whether disabled or otherwise, on discharge from the Navy or Army, has presented an Interim Report recommending that, as an experiment, 50 men who have been discharged from the Navy or Army owing to disablement should be given a course of training in an Agricultural College, with a view to obtaining for them permanent employment on the land, and, in the case of those proving specially capable, fitting them to become occupiers of small holdings.

This recommendation has been approved by Lord Selborne and endorsed by the War Office, and the Treasury have agreed to place funds at the disposal of the Board of Agriculture and Fisheries to defray the cost of the experiment.

It is proposed that the men selected shall be sent to the Harper Adams Agricultural College, Newport, Salop, and to the College of Agriculture and Horticulture, Holmes Chapel, Cheshire, where they will be provided with board and lodging and be given a course of training in agriculture and horticulture free of charge to themselves. No deductions will be made from their disability pensions. In the first instance the course will extend over one term of about 12 weeks, at the end of which time those men whose conduct and work have been

satisfactory, and who seem capable of succeeding as small holders, will be given a further course extending over two more terms, so that they may receive instruction in the whole cycle of agricultural and horticultural operations. There should be no difficulty in obtaining satisfactory employment on farms for those men who are not retained for more than one term. During the course the men will be under the control of the Principal and subject to the ordinary rules of the College.

Any men who have been discharged from the Navy or Army on account of disablement, and who desire to receive this course of training, should apply at once to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, S.W., for a form of application.

Storage of Fruit.

OWING to the necessary demands of the Military Authorities on the railway companies serving some of the fruit-growing districts, it may be found that it would be contrary to the public interest that they should accept for transport the whole of the crop of apples and pears as picked. It may, therefore, be necessary for growers to store some part of their crop. Notes on the storage of fruit are included in the Board's Special Leaflet No. 6, which may be obtained on application at their offices at Whitehall Place, London, S.W.

If the apples or pears are ripe, or are intended for immediate consumption, the earliest possible notice that the fruit will be offered for carrage by rail should be given to the local officials of the Company concerned. In all such cases it is important that the quantity to be forwarded should be specified at the station from which it is proposed to consign the fruit.

Foot-and-Mouth Disease.

THE existence of foot-and-mouth disease amongst animals on premises at Monkton Combe, near Bath, Somerset, was confirmed on 21st October, 1915.

Precautions were at once taken to prevent the spread of the disease, and an Order was made prohibiting the movement of animals in a large area surrounding the infected farm. Investigation showed, however, that the disease had been in existence some considerable time before it was detected and reported. It was not, therefore, a matter for surprise that the disease quickly appeared amongst animals on other premises in the neighbourhood which had been in contact with the diseased animals or on premises which were in close proximity thereto. In this way 37 further outbreaks of the disease have been confirmed in the same locality up to the 12th inst., and one upon premises at Hubberston, Angle, near Milford, *Pembrokeshire*, to which contact animals had been moved.

In the Pembrokeshire case, which was confirmed on the 28th ult., the movement of animals over an area surrounding the infected premises was, as a precautionary measure, at once prohibited. No further outbreak has since been reported in this district, and the Scheduled District has been considerably contracted and the restrictions on the movement of animals in the reduced area modified.

The Somerset Prohibition of Movement Order was modified on the

1st inst. to allow movement into and within an outer zone of the Scheduled District for slaughter, and again on the 8th inst. as regards a larger zone to allow movement by licence for any necessary purpose. Owing to outbreaks of the disease near Bristol the above-mentioned zone, in which movement by licence was allowed, was extended in the direction of the Bristol Channel to include an area not originally comprised within the Scheduled District.

Destruction of Foxes.

THE President of the Board of Agriculture and Fisheries, in view of the inevitable increase in the number of foxes consequent on the reduction or cessation of fox-hunting during the War, has drawn the attention of the Masters of Foxhounds Association to the desirability of adopting measures to destroy foxes, and the President of the Association has issued a letter urging Hunt Clubs throughout England and Wales to do their best in this manner to protect the interests of farmers and poultry-keepers. Lord Selborne has also arranged for enquiry by his Department as to the extent to which the surplus of foxes is being reduced, and to what degree their depredations are still affecting the actual and potential supply of food.

This information will be placed at the disposal of the County War Agricultural Committees and the District Sub-Committees in order that additional consideration may be given to the protection of poultry in localities where the results of the enquiry indicate that such a course is desirable.

Third Year-Book of Agricultural Statistics.

THE International Institute of Agriculture has just published, in French, the Third International Year-Book of Agricultural Statistics (*Annuaire International de Statistique Agricole* 1913 *et* 1914). It is the intention of the Institute to issue this volume every two years. The first Year-Book appeared in 1912 and related to the decennial period 1901–1910; the second Year-Book, issued at the beginning of 1915 dealt with the period 1903–1912. The present volume is a collection of statistical tables, systematically grouped, giving the following particulars for the countries throughout practically the whole of the civilised world in the decennial period 1905–1914:—(1) Total area and population; (2) Area and production of principal crops; (3) Numbers of live stock; (4) Importation and exportation of agricultural produce; (5) Consumption and prices of agricultural produce; (6) Trade in artificial manures. The last is a new section in the Year-Book.

The figures for all countries are expressed in the same measures, and grouped into concise and intelligible tables, so as to enable the reader to form an opinion of the evolution of agriculture either in individual countries or in practically the whole world.

The Year-Book may be obtained from the Board of Agriculture and Fisheries, Whitehall Place, London, S.W., price 4s., post free

The attention of readers of this *Journal* is drawn to Leaflet No. 257, which gives some account of the work, aims, and publications of the International Institute of Agriculture. With regard to the Institute's publications, these are on sale at the Office of the Board, and particulars as to prices will be found in the Leaflet, copies of which may be obtained free on application.

THE following circular letter, dated 14th October, 1915, has been ssued to the secretaries of the County War Agricultural Committees :—

Increasing the Production of Home-Grown Food.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to enclose herewith for the information of the County War Agricultural Committee, 30 copies of a statement * of the acreage under Clover and Rotation Grasses, other arable land and permanent pasture in each County in the years 1875, 1885, 1895, 1905 and 1915.

Lord Selborne hopes that the figures relating to your County will be of service to the Committee in considering the extent to which it may be possible to secure an increase of the arable area.

Additional copies of the statement will be supplied on application.

Statements are in preparation showing the acreage under each separate crop in the current year in each County and in each Petty Sessional Division, and copies of these will be supplied to you as soon as possible.

I am, etc.,
SYDNEY OLIVIER, *Secretary*.

Produce of Hops.

PRELIMINARY STATEMENT showing the estimated total production of hops in the years 1915 and 1914, with the acreage and estimated average yield per statute acre in each county of England in which hops were grown.

COUNTIES, &c.	Estimated Total Produce.		Acreage Returned on 4th June.		Estimated Average Yield per Acre.	
	1915.	1914.	**1915.**	1914.	**1915.**	1914.
	Cwt.	Cwt.	Acres.	Acres.	Cwt.	Cwt.
KENT East ...	**54,819**	94,877	**5,727**	6,174	**9·57**	15·37
KENT Mid. ...	**68,361**	104,405	**7,184**	7,604	**9·52**	13·73
KENT Weald ...	**65,646**	119,422	**8,370**	8,848	**7·84**	13·50
KENT Total, Kent	**188,826**	318,704	**21,281**	22,626	**8·87**	14·09
HANTS	**6,131**	22,262	**1,514**	1,580	**4·05**	14·09
HEREFORD	**20,737**	70,478	**5,405**	5,507	**3·84**	12·80
SURREY	**1,628**	8,188	**552**	585	**2·95**	14·00
SUSSEX	**22,173**	43,980	**2,864**	3,036	**7·74**	14·49
WORCESTER ...	**14,469**	42,238	**2,961**	3,194	**4·89**	13·22
OTHER COUNTIES† ...	**137**	1,408	**113**	133	**1·21**	10·59
TOTAL	**254,101**	507,258	**34,690**	36,661	**7·32**	13·84

NOTE.—The total production of hops in 1915, viz., 254,101 cwt., is practically half the amount produced last year. and almost identical with the total production of 1913. The yield per acre, 7⅓ cwt., is not quite 2½ cwt. below the average of the ten years 1905–14, viz., 9·73 cwt.

* Not printed.
† Gloucester, Salop and Stafford.

Produce of Corn, Pulse and Hay Crops in England and Wales in 1915.

ON 5th November the Board issued the following preliminary statement showing the estimated total produce and yield per acre of the corn, pulse, and hay crops in England and Wales in the year 1915, with comparisons for 1914, and the average yield per acre of the 10 years 1905–1914.

—	Crops.	Estimated Total Produce.		Acreage.		Average Estimated Yield per acre.		Average of the Ten Years 1905-1914.
		1915.	1914.	1915.	1914.	1915.	1914.	
		Quarters.	Quarters.	Acres.	Acres.	Bush.	Bush.	Bush.
ENGLAND AND WALES.	Wheat ..	8,490,692	7,307,036	2,170,170	1,807,498	31·30	32·34	32·02
	Barley ..	4,558,069	6,173,948	1,231,714	1,504,771	29·60	32·82	33·18
	Oats ..	10,452,128	9,553,727	2,088,009	1,929,617	40·05	39·61	40·22
	Beans ..	891,599	1,083,702	257,655	284,371	27·78	30·49	30·28
	Peas ..	299,226	372,387	98,265	129,528	24·36	23·00	26·39
		Tons.	Tons.			Cwt.	Cwt.	Cwt.
	Seeds Hay*	2,287,703	2,117,137	1,538,067	1,554,907	29·75	27·23	28·87
	Meadow Hay†	4,299,354	5,148,241	4,651,609	4,785,451	18·49	21·52	23·25
		Quarters.	Quarters.			Bush.	Bush.	Bush.
ENGLAND	Wheat ..	8,319,257	7,175,950	2,121,519	1,770,470	31·37	32·43	32·13
	Barley ..	4,257,621	5,841,499	1,151,536	1,420,346	29·58	32·90	33·32
	Oats ..	9,565,833	8,653,284	1,888,530	1,730,082	40·52	40·01	40·76
	Beans ..	891,098	1,079,369	256,635	283,194	27·78	30·49	30·30
	Peas ..	298,266	371,183	97,929	129,116	24·37	23·00	26·41
		Tons.	Tons.			Cwt.	Cwt.	Cwt.
	Seeds Hay	2,080,215	1,906,381	1,372,922	1,390,898	30·30	27·41	29·25
	Meadow Hay	3,807,457	4,603,527	4,118,843	4,239,074	18·49	21·72	23·62
		Quarters.	Quarters.			Bush.	Bush.	Bush.
WALES ..	Wheat ..	171,433	131,086	48,651	37,028	28·19	28·32	27·57
	Barley ..	300,448	332,449	80,178	84,425	29·98	31·50	31·06
	Oats ..	886,295	900,443	199,479	199,535	35·54	36·10	35·26
	Beans ..	3,501	4,333	1,020	1,177	27·46	29·45	27·33
	Peas ..	960	1,204	336	412	22·86	23·38	22·95
		Tons.	Tons.			Cwt.	Cwt.	Cwt.
	Seeds Hay	207,488	210,756	165,145	164,009	25·13	25·70	25·60
	Meadow Hay	491,897	544,714	532,766	546,377	18·47	19·94	20·25

* Hay from Clover, Sainfoin, and Grasses under rotation.
† Hay from Permanent Grass.

NOTE.—The total production of wheat in England and Wales—8,490,692 qr.—is 1,180,000 qr. more than in 1914 when the area under this crop was 363,000 acres less, and is the largest since 1898. The yield this year is one bush. per acre less than in 1914, and nearly ⅔ of a bush. below the average of the ten years 1905–14. The total production of barley is much the lowest recorded, as a consequence of a greatly decreased acreage, coincident with a poor average yield per acre; the latter is 3¼ bush. under that of last year, and 3⅓ bush. under the ten years' average. Oats have yielded a little more per acre than last year, and are only slightly under the average, and owing to an increased acreage the total production is 900,000 qr. more than last year, and is the highest since 1910. Beans are 2½ bush. per acre under the average, and on a decreased acreage the total yield of 895,000 qr. is the lowest since 1904. The total production of peas harvested is just under 300,000 qr.; the yield per acre is 1⅓ bush. above the very poor crop of 1914, but is 2 bush. under the average. The production of hay from clovers and rotation grasses is considerably more than was anticipated early in the season, the yield of the second cut being in many cases equal to or even better than that of the first; the yield per acre is nearly 1 cwt. above the average, and 2½ cwt. above last year. Meadow hay, on the other hand, is 4¾ cwt. per acre below average. The total production of both kinds of hay amounts to 6,600,000 tons, which, with the exception of the very poor crop of 1911, is the smallest since 1901.

The estimate of the hop crop was issued on the 15th ult.; the returns of the production of potatoes and roots are collected at a later date, and will be issued subsequently.

Notes on Crop Prospects and Live Stock Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for October, 1915, issued by the International Institute of Agriculture, contains estimates of the production of cereal crops in the Northern Hemisphere this year. The countries for which it is possible to give approximate estimates are as follows.—In *Europe*—Hungary, Denmark, Spain, France, Great Britain, Ireland, Italy, Luxemburg, Norway, Netherlands, Rumania, Russia in Europe (54 Governments), Switzerland; in *America*—Canada, United States; in *Asia*—India, Japan, Russia in Asia (10 governments in 1915 and 9 governments in 1914); in *Africa*—Egypt, Tunis.

Wheat.—The total production in the above-mentioned countries is estimated to amount to 451,233,000 qr. in 1914–15, against 372,052,000 qr. in 1913–14, or an increase of 21·3 per cent., while the area under cultivation was also greater by 6·8 per cent.

Rye.—In the same countries as above, excluding Great Britain, India, Japan, Egypt, and Tunis, the total production is estimated at 137,129,000 qr. in 1914–15, against 119,503,000 qr. in 1913–14, or an increase of 14·7 per cent. The area sown, however, was less by 0·4 per cent.

Barley.—For the specified countries, excluding India, the estimated production is placed at 145,983,000 qr. in 1914–15, as compared with 125,260,000 qr. in 1913–14, the increase being equal to 16·5 per cent. The area planted showed a decrease of 1·2 per cent.

Oats.—The total production in the above countries, excluding India, Japan, and Egypt, is estimated at 395,126,000 qr. in 1914–15, against 321,733,000 qr. in 1913–14, or an increase of 22·8 per cent., while the area under cultivation was greater by 1·1 per cent.

Maize.—In Italy, Rumania, Russia in Europe (54 governments), Switzerland, Canada, United States, Japan, and Russia in Asia (10 governments in 1915 and 9 governments in 1914), the total production is estimated at 390,498,000 qr. this year, against 348,300,000 qr. last year, or an increase of 12·1 per cent., the area under cultivation showing an increase of 5·9 per cent.

New Zealand.—The preliminary figures for 1914–15 give the production of wheat at 686,000 qr. against 654,000 qr. in 1913–14, or an increase of 4·9 per cent., while the area under cultivation was greater by 13·7 per cent. The production of barley decreased 50·5 per cent., being 75,000 qr. against 151,000 qr. in 1913–14; the area sown was less than in 1913–14 by 42·7 per cent. The production of oats is estimated at 1,429,000 qr. against 1,842,000 qr. in 1913–14, or a decrease of 22·4 per cent., the area sown decreasing 20·5 per cent., while maize is estimated at 33,000 qr. against 39,000 qr. in 1913–14, a decrease of 15·7 per cent., the area under cultivation decreasing by a like percentage.

France.—The condition of potatoes on the 1st October was officially estimated at 52 as compared with 53 on the 1st September, and of maize at 64 against 68. (80 = good, 60 = fairly good, and 50 = passable). (The *London Grain, Seed and Oil Reporter*, 28th October.)

United States.—The Crop Reporting Board of the Bureau of Statistics of the Department of Agriculture states that the total yield of maize is estimated at 3,091,000,000 bush. as compared with 2,705,692,000 bush. last year, with an average quality of 90·3 against 85·1 in 1914. The quantity of old maize estimated to be in farmers' hands on November 1st was 96,001,000 bush. The yield of linseed is estimated at 18,000,000 bush. as compared with 15,973,000 bush. last year, and the quality at 99·3 against 90·4 in 1914. The average weight of wheat per bush. is estimated at 57·9 lb. against 58·0 lb. last year; of oats 33·0 lb. against 31·5 lb.; and of barley 47·4 lb. against 46·2 lb. in 1914. (The *London Grain, Seed and Oil Reporter*, 8th November.)

Russia.—The official "Trade Gazette" of Petrograd of 25th September (8th October) gives, from data of the All-Russian Sugar Refiners' Society, the area under sugar-beet as 1,747,660 acres against 1,853,806 acres last year, and the total production (exclusive of the yield in Russian Poland, now under German occupation) is estimated at 11,812,200 tons as compared with 12,155,758 tons in 1914.

Canada.—According to a report issued by the Census and Statistics Office at Ottawa, the yield of the crops is estimated as follows:—Wheat 336,258,000 bush., an increase of 174,978,000 bush. as compared with last year; oats 481,035,500 bush. against 311,426,000 bush.; barley 50,868,000 bush. against 34,591,000 bush.; and rye 2,478,500 bush. against 2,258,000 bush. The average quality of the crops ranges between 90 and 93 per cent. of a standard crop.

Argentina.—According to the preliminary official estimate the areas sown with the crops are as follows (in acres):—Wheat 16,321,000 as compared with 15,464,000 in 1914; linseed 4,058,000 against 4,255,000; and oats 2,630,000 against 2,865,000. (The *London Grain, Seed and Oil Reporter*, 20th October.)

South Australia.—The area sown with wheat is officially reported to be 10 per cent. in excess of last year's acreage, and the prospective yield is estimated at 29 million bush., or 4 million bush. larger than the previous record. (The *London Grain, Seed and Oil Reporter*, 22nd October.)

Hops.—*United States.*—His Majesty's Consul at Portland, Oregon, in a report, dated 27th September, stated that the hop crop in Oregon was estimated at 90,000 to 100,000 bales, in Washington at 35,000 bales, in California at 125,000 bales, and in the State of New York at 10,000 bales, making a total crop for the United States of 260,000 to 270,000 bales. It was estimated that there were about 5,000 bales in stock throughout the country from last season's crop. The prices ruling at the date of the report were from 5*d.* to 6*d.* per lb., being considerably lower than usual owing to abnormal conditions.

Live Stock in France.—The number of horses on 1st July, 1915, was 2,227,209, against 3,230,700 on 31st December, 1913; while cattle totalled 12,286,849, against 14,807,380; sheep 13,483,189, against 16,213,030, and pigs 5,490,796, against 7,047,750. (*Bulletin of Agricultural and Commercial Statistics*, October, 1915.)

Live Stock in Canada.—Horses numbered 2,996,099 on 30th June, 1915, against 2,947,738 on the same date in the previous year, or an increase of 1·6 per cent. Milk cows totalled 2,666,846 against 2,673,286,

or a decrease of 0·2 per cent., but other cattle showed an increase of 1·1 per cent., the total being 3,399,155 in 1915 against 3,363,531 in 1914. Sheep decreased 0·9 per cent., there being 2,038,662 in 1915 as compared with 2,058,045 in 1914, while pigs also showed a decrease, amounting to 9·4 per cent., the total for 1915 being 3,111,900 against 3,434,261 in 1914. (*Bulletin of Agricultural and Commercial Statistics*, October, 1915.)

Live Stock in New Zealand.—The "Second Interim Return of Sheep in the Dominion" for the year ended 30th April, 1915, gives the number of sheep as 24,824,394, against 24,798,763 in the preceding year, or an increase of 0·1 per cent. (*Bulletin of Agricultural and Commercial Statistics*, October, 1915.)

Agricultural Conditions in England and Wales on 1st November.

THE reports furnished by the Crop Reporters of the Board on agricultural conditions in England and Wales indicate that, on the whole, the corn crops were secured in good condition. Wheat is of good quality generally, and is better than the other two cereals. The quality of barley and oats is variable, and in the Eastern Counties especially is somewhat inferior. Barley is frequently reported to be discoloured.

The bulk of the potato crop has now been lifted, under favourable conditions. Disease is reported from most parts of the country, but with few and unimportant exceptions the attacks are not serious.

The lifting of the mangold crop is mostly well advanced; the roots are reported to be sound generally, but often small. Turnips and swedes are still making growth, and although also small, at present promise to be a sound crop in most parts; very few have yet been lifted. Seeds, with few exceptions, are very promising.

Autumn cultivation is in many districts not so forward as usual, ploughing having been delayed by the hardness of the ground, and also, in many cases, by the shortage of labour. In other districts, more especially in the south-western and northern counties, good progress has been made, and a fair proportion of the wheat sown.

Live stock have done well during October. In most parts the pastures are still showing a fair supply of grass. The outlook for winter keep, however, is in many cases not altogether satisfactory; the yield of hay was, on the whole, short, and the root crops will probably be somewhat deficient.

Agricultural Labour in England and Wales during October.

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st November, the supply of labour in England and Wales during October continued to be short in all parts of the country, and the deficiency hindered autumn cultivation in a number of districts.

The following local summaries give further details regarding agricultural labour in the different districts of England and Wales:—

Northumberland, Durham, Cumberland and Westmorland.—In some districts the shortage in the supply of labour was being keenly felt, and casual labour for potato lifting was often scarce. On the whole, however, farm work was about as forward as usual.

Lancashire and Cheshire.—There was a general shortage of labour throughout the district, but the deficiency was partially made up by resort to female and boy labour, and the fine weather materially assisted the autumn work. It was feared that the difficulty may become more acute after the November hirings.

Yorkshire.—Labour was deficient is most districts. Casual labour was more plentiful, but permanent labourers were very scarce.

Shropshire and Stafford.—Labour was scarce, particularly temporary hands, and in south-east Stafford stockmen and horsemen were difficult to obtain.

Derby, Nottingham, Leicester, and Rutland.—Labour was still deficient everywhere, but the fine weather during October eased the position.

Lincoln and Norfolk.—Labour was everywhere very short, but the weather helped matters, and women have been employed as far as possible.

Suffolk, Cambridge, and Huntingdon.—Labour was still scarce and wages high. The scarcity of labour was most notable where threshing was in progress.

Bedford, Northampton, and Warwick.—Labour still appeared to be scarce everywhere, and more enlistments were reported to have taken place.

Buckingham, Oxford, and Berkshire.—The supply of labour was deficient everywhere, but the weather was such that it was possible to carry out operations with a minimum supply. Women and children have been assisting in some districts.

Worcester, Hereford, and Gloucester.—Labour was still scarce, owing to the increased enlistment of men for the Army.

Cornwall, Devon, and Somerset.—The supply of labour was everywhere short, and in Somerset the scarcity was being severely felt Threshing was being done by co-operation between neighbours. In some districts it was said to be impossible to get women to work in the fields.

Dorset, Wiltshire, and Hampshire.—Labour was generally very deficient. Skilled labour was particularly scarce, and the difficulty was being met by omitting all but indispensable operations and resorting to female labour, especially for milking and root lifting.

Surrey, Kent, and Sussex.—Labour was still scarce, but the shortage of labour had not been very seriously felt owing to the favourable weather.

Essex, Hertford, and Middlesex.—The supply of labour was very deficient, but women have been freely employed in lifting potatoes and roots. Complaint was made of the dearness of labour in south-east Herts and central Middlesex.

North Wales.—The supply of labour was short, but generally proved sufficient.

Mid-Wales.—The supply proved sufficient for requirements in most districts, but in one or two places casual labourers were difficult to obtain.

South Wales.—Labour was generally scarce, especially temporary hands for potato and root lifting.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on 1st November, 1915, certain diseases of animals existed in the countries specified :—

Austria (*on the 13th Oct.*).
Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (*month of Sept.*).
Anthrax, Foot-and-Mouth Disease (178 outbreaks), Swine Erysipelas, Swine Fever.

France, (*for the period 3rd—16th Oct.*).
Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Swine Erysipelas, Swine Fever.

Germany (*for the period 1st—15th Oct.*).
Foot-and-Mouth Disease, Glanders and Farcy, Swine Fever.

Holland (*month of Sept.*).
Anthrax, Foot-and-Mouth Disease (88 outbreaks), Foot-rot, Swine Erysipelas.

Hungary (*on the 13th Oct.*).
Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (*for the period 11th—17th Oct.*).
Anthrax, Blackleg, Foot-and-Mouth Disease (3,085 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (*month of Sept.*).
Anthrax, Blackleg, Swine Fever.

Rumania (*for the period 21st—29th Sept.*).
Anthrax, Foot-and-Mouth Disease, Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (*month of June*).
Anthrax, Foot-and-Mouth Disease (397,356 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (*month of Aug.*).
Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of Sept.*).
Anthrax, Blackleg, Foot-and-Mouth Disease, Swine Erysipelas.

Switzerland (*for the period 18th—24th Oct.*).
Anthrax, Blackleg, Foot-and-Mouth Disease (7 "étables" entailing 110 animals, of which 3 "étables" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries :—Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during October.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
Week ending Oct. 2nd:	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours
England, N.E. ...	46·7	−5·6	0·39	10	0	3	5·4	+1·5
England, E.	48·3	−5·3	0·95	24	+11	4	4·1	−0·3
Midland Counties ...	46·8	−5·6	0·44	11	−3	3	3·9	0·0
England, S.E.... ...	48·6	−6·4	1·33	34	+18	3	3·2	−1·2
England, N.W. ...	47·3	−5·6	0·17	4	−17	3	4·5	+0·8
England, S.W. ...	49·5	−4·8	1·04	26	+3	5	2·6	−1·5
English Channel ...	53·4	−4·1	1·15	29	+9	6	2·7	−2·5
Week ending Oct. 9th:								
England, N.E.... ...	49·5	−0·9	0·06	2	−11	1	2·4	−1·3
England, E.	50·7	−0·8	0·24	6	−9	3	3·0	−1·0
Midland Counties ...	49·0	−1·3	0·03	1	−15	1	1·4	−2·0
England, S.E.... ...	51·2	−1·7	0·10	3	−15	2	2·8	−1·1
England, N.W. ...	50·2	−0·9	0·15	4	−20	1	2·7	−0·5
England, S.W. ...	51·3	−1·1	0·37	9	−16	1	2·8	−1·0
English Channel ...	54·1	−1·6	0·43	11	−11	1	3·8	−0·7
Week ending Oct. 16th:								
England, N.E. ...	52·5	+3·7	0·19	5	−12	2	2·7	−0·7
England, E.	55·0	+5·2	0·04	1	−15	1	3·0	−0·6
Midland Counties ...	52·8	+4·2	0·11	3	−14	2	1·6	−1·7
England, S.E.... ...	54·9	+3·8	0·06	2	−16	2	2·3	−1·3
England, N.W. ...	52·7	+3·1	0·37	10	−14	3	3·7	+0·8
England, S.W. ...	54·4	+3·5	0·32	8	−18	5	3·1	−0·4
English Channel ...	56·0	+1·7	0·13	3	−19	3	4·2	0·0
Week ending Oct. 23rd:								
England, N.E. ...	47·7	+0·2	0·22	6	−13	3	1·3	−1·8
England, E.	49·3	+1·0	0·31	8	−9	3	2·2	−1·1
Midland Counties ...	46·6	−0·6	0·52	13	−4	2	0·8	−2·2
England, S.E.... ...	50·0	+0·3	0·62	16	−3	3	1·9	−1·5
England, N.W. ...	48·2	−0·1	0·48	12	−10	2	2·0	−0·7
England, S.W. ...	49·4	−0·3	1·40	36	+10	4	3·1	−0·2
English Channel ...	52·8	−0·4	0·89	23	0	4	2·7	−1·3
Week ending Oct. 30th:								
England, N.E. ...	43·7	−2·7	0·82	21	+2	5	1·6	−1·1
England, E.	45·5	−1·6	0·86	22	+6	5	1·5	−1·5
Midland Counties ...	43·6	−2·5	0·92	24	+7	4	2·0	−0·5
England, S.E.... ...	46·0	−2·6	1·31	33	+13	4	1·8	−1·2
England, N.W. ...	44·5	−2·7	0·79	20	−2	4	2·7	+0·2
England, S.W. ...	46·0	−2·8	1·67	42	+16	5	3·6	+0·7
English Channel ...	49·6	2·7	1·37	35	+12	6	3·7	+0·3

* 1 inch = 25·4 millimetres.

Unit Prices of Artificial Manures.

Statement of cost to the purchaser of 1 per cent. per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	*s. d.*	*s. d.*	*s. d.*
Nitrogen from:				
*Sulphate of Ammonia pure ... 95%	16 0	—	15 9	—
93%	—	15 9	15 7½	—
Calcium Cyanamide ...	—	—	14 0½	—
Nitrate of Soda pure 95%	—	20 0	20 0	—
90%	19 10	—	20 0	—
Nitrate of Lime ...	—	—	—	—
Soluble Phosphates from:				
Superphosphate 35%	2 6½	2 2	2 6½	2 11
,, 33%	2 6½	2 3	2 7	—
,, 30%	2 7½	2 4	2 8½	3 1
,, 26%	2 10½	2 6	2 10½	3 4½
Dissolved Bones	3 9½	3 4	3 7	3 9
Allowed for Nitrogen	*19 6½*	*17 1*	*18 7*	*19 3*
Allowed for Insol. Phos.	*2 1½*	*1 10½*	*2 0½*	*2 1*
Insoluble Phosphates (Citric Soluble) from:				
Basic Slag	2 2	2 0½	1 10	—
Insoluble Phosphates from:				
Basic Slag	—	—	—	—
Bone Meal	1 10½	1 11	1 8½	1 10
Allowed for Nitrogen	*17 0*	*17 4½*	*15 8*	*16 9*
Steamed Bone Flour ...	1 9½	1 9½	1 11	—
Allowed for Nitrogen	*16 6½*	*16 7½*	*18 1½*	—
Potash from:				
Kainit	—	—	—	—
Sulphate of Potash ...	—	—	—	—
Muriate of Potash ...	—	—	—	—
Potash Salts	—	—	—	—

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the

* By a special arrangement made with the Sulphate of Ammonia Association, farmers will be able to purchase a certain amount of sulphate of ammonia from manufacturers for £14 10s. per ton, in bags, net cash, delivered in lots of not less than 10 cwt., f.o.r. at the makers' works. These terms apply to sales of a quantity

various sources, at certain ports and Manufacturing Centres, for November, 1915.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
—	—	15 6	15 6	—	—
—	15 8½	15 8	—	15 3½	15 11½
—	13 4½	—	—	—	14 3½
—	18 5½	18 8½	—	19 0½	18 8½
—	—	—	20 0	19 8	19 4
—	—	—	—	—	—
2 11	2 8½	2 7½	2 5½	2 5½	2 7
—	2 9½	2 8½	2 6½	2 6½	2 7
3 1	2 10½	2 9½	2 7½	2 7½	2 7½
3 4½	3 2	3 1	2 10½	2 10½	2 10½
3 10½	4 3	4 3	3 10	3 11	3 10½
19 11	*21 9½*	*22 1½*	*19 9*	*20 2½*	*19 10*
2 2	*2 4½*	*2 5*	*2 2*	*2 2½*	*2 2*
—	1 11	—	—	2 3½	2 6
—	—	—	—	—	1 10
2 0½	1 11	1 11	1 8	1 8½	1 10½
18 7½	*17 7½*	*17 3½*	*15 2½*	*15 10½*	*17 3*
—	—	—	1 7½	1 9	—
—	—	—	*14 8½*	*16 2½*	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and rebagging the ingredients, bags, and loss of weight.

reserved for autumn use, and held during November and December, so long as the reserved quantity remains unsold. The price stated is for sulphate of ammonia containing 20·16 N. The unit price, therefore, works out at 14*s.* 4½*d.*

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	35	63	477	620
Animals attacked	40	67	543	679
Foot-and-Mouth Disease:—				
Outbreaks	21	2	21	24
Animals attacked	115	16	115	124
Glanders (including Farcy):—				
Outbreaks	5	5	41	86
Animals attacked	8	16	74	265
Parasitic Mange:—				
Outbreaks	74	†—	*702	†1,530
Animals attacked	155	†—	*1,509	†2,642
Sheep-Scab:—				
Outbreaks	2	4	166	159
Swine Fever:—				
Outbreaks	287	525	3,450	3,682
Swine Slaughtered as diseased or exposed to infection ...	1,017	4,449	14,937	35,508

* Figures for seven months only. † The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	—	—	1	1
Animals attacked	—	—	1	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	76
Animals attacked	—	—	—	957
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	3	—
Parasitic Mange:—				
Outbreaks	6	4	64	71
Sheep-Scab:—				
Outbreaks	31	27	346	434
Swine Fever:—				
Outbreaks	26	17	219	178
Swine Slaughtered as diseased or exposed to infection ...	156	38	1,256	880

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in October and September, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	October. First Quality.	October. Second Quality.	September. First Quality.	September. Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	11 4	10 8	12 4	11 4
Herefords	11 10	10 9	12 8	11 7
Shorthorns	11 8	10 7	12 7	11 6
Devons	11 11	10 5	12 9	11 9
Welsh Runts	11 6	10 8	12 5	11 9
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	10½	9½	10½	9½
Sheep :—				
Downs	10¾	9¾	11	10
Longwools	10	9	10½	9½
Cheviots	11	9¾	11½	10¼
Blackfaced	10	9	10½	9½
Welsh	9	8¾	10	9⅛
Cross-breds	10¾	9½	11	10
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	10 6	9 10	10 4	9 9
Porkers	11 3	10 7	10 9	10 3
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	27 15	22 15	27 5	22 10
,, —Calvers ...	26 13	22 1	25 13	21 7
Other Breeds—In Milk ...	25 19	20 6	25 3	19 16
,, —Calvers ...	21 10	19 15	20 0	18 10
Calves for Rearing	3 1	2 6	3 3	2 7
Store Cattle :—				
Shorthorns—Yearlings ...	13 2	11 3	13 17	11 17
,, —Two-year-olds...	18 7	16 7	20 6	17 10
,, —Three-year-olds	24 5	20 9	25 17	22 6
Herefords —Two-year-olds...	20 16	16 15	21 6	18 7
Devons— ,,	18 10	15 6	20 2	17 4
Welsh Runts— ,,	19 10	16 19	20 14	19 6
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	48 3	40 3	46 10	39 8
Store Pigs :—				
8 to 12 weeks old	28 1	22 0	28 11	23 3
12 to 16 weeks old	45 11	35 8	46 0	35 3

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in October, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
		s. d.	s. d.	s. d.	s. d.	s. d.
BEEF :—						
English	1st	76 0	75 0	—	76 6	74 0
	2nd	72 6	71 0	—	71 6	70 0
Cow and Bull	1st	67 0	68 0	66 0	66 6	66 6
	2nd	64 0	63 6	61 0	62 0	62 6
Irish: Port Killed	1st	70 0	71 0	71 6	74 0	71 0
	2nd	65 6	69 0	67 0	69 6	67 0
Argentine Frozen—						
Hind Quarters	1st	70 6	—	70 0	72 6	70 0
Fore ,, ...	1st	62 6	—	63 0	58 6	63 0
Argentine Chilled—						
Hind Quarters	1st	80 0	74 6	76 6	77 6	76 6
Fore ,, ...	1st	61 6	59 0	59 6	59 6	59 6
Australian Frozen—						
Hind Quarters	1st	71 6	69 0	66 6	70 0	66 6
Fore ,, ...	1st	62 0	63 6	60 6	60 6	61 0
VEAL :—						
British	1st	—	—	—	86 6	—
	2nd	79 6	—	—	77 0	—
Foreign...	1st	—	—	—	—	—
MUTTON :—						
Scotch	1st	—	—	92 0	92 0	92 0
	2nd	86 6	—	87 6	86 6	89 0
English...	1st	88 6	89 0	84 0	87 0	89 0
	2nd	84 0	84 0	74 6	80 6	85 0
Irish: Port Killed	1st	86 6	—	83 6	81 6	85 0
	2nd	84 0	—	78 0	76 6	81 0
Argentine Frozen	1st	59 0	59 6	56 0	63 6	56 0
Australian ,, ...	1st	56 6	57 6	53 6	58 6	54 0
New Zealand ,, ...	1st	—	—	—	70 0	—
LAMB :—						
British	1st	88 6	89 0	88 6	92 6	92 0
	2nd	85 0	84 0	79 6	85 6	88 6
New Zealand	1st	80 0	79 6	79 6	77 6	79 6
Australian	1st	73 0	70 0	69 6	72 6	69 6
Argentine	1st	73 6	72 6	71 6	70 6	71 6
PORK :—						
British	1st	97 0	88 6	94 6	101 6	95 0
	2nd	91 0	84 0	87 6	92 0	90 6
Foreign...	1st	—	—	—	—	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in October, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	19 0	17 0	—	—	19 0	18 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	171 6	167 0	173 0	168 6	175 6	170 0
„ Factory	144 6	137 0	145 0	137 0	149 6	141 6
Danish...	—	—	191 6	187 0	190 6	185 6
French...	—	—	—	—	162 0	156 0
Russian	142 6	135 6	—	138 0	141 6	135 6
Australian	—	—	—	—	—	—
New Zealand	—	—	—	—	—	—
Argentine	—	—	—	—	—	—
CHEESE :—						
British—						
Cheddar	93 0	84 0	94 0	92 0	95 0	87 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	98 0	94 6	99 6	93 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	82 0	78 6	82 6	78 6	80 0	77 6
BACON :—						
Irish (Green)	108 0	104 0	106 6	103 0	105 0	103 0
Canadian (Green sides)	96 6	90 0	96 0	92 0	95 0	90 0
HAMS :—						
York (Dried or Smoked)	130 6	126 6	—	—	137 0	131 6
Irish (Dried or Smoked)	—	—	—	—	129 0	123 6
American (Green) (long cut)	81 0	77 0	83 6	79 6	84 0	80 6
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120	per 120.
British...	20 0	—	—	—	21 5	19 9
Irish	18 7	18 1	17 4	16 5	18 7	17 10
Danish...	—	—	—	—	20 0	18 6
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen ...	91 0	77 6	—	—	93 6	85 0
Edward VII.	91 6	83 0	71 6	66 6	91 0	81 6
Up-to-date	86 6	76 0	66 6	63 6	88 6	79 0
HAY :—						
Clover...	—	—	166 0	130 0	128 6	117 6
Meadow	—	—	—	—	120 6	110 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1913, 1914 and 1915.

Weeks ended (*in* 1915).		WHEAT.			BARLEY.			OATS.		
		1913.	1914.	1915.	1913.	1914.	1915.	1913.	1914.	1915.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan.	2 ...	30 5	31 1	44 4	28 6	26 2	29 10	19 10	18 2	26 6
,,	9 ...	30 3	30 11	46 2	28 4	25 11	29 7	19 2	18 4	26 5
,,	16 ...	30 5	31 0	48 9	28 6	26 0	30 5	19 4	18 6	27 6
,,	23 ...	30 11	30 11	51 6	28 10	26 3	31 3	19 4	18 11	28 10
,,	30 ...	31 1	31 1	52 8	28 11	26 6	32 5	20 2	19 1	29 10
Feb.	6 ...	31 0	31 0	53 3	28 10	26 7	33 7	20 1	18 9	30 3
,,	13 ...	30 9	31 0	54 8	29 1	26 7	34 7	20 2	18 11	31 1
,,	20 ...	30 11	31 0	56 0	28 8	26 7	34 11	20 7	18 11	31 5
,,	27 ...	31 0	31 0	56 0	28 6	26 6	35 3	20 4	18 11	31 8
Mar.	6 ...	31 3	31 5	55 11	28 5	26 2	34 6	20 0	18 9	31 8
,,	13 ...	31 1	31 6	54 8	27 11	26 0	33 5	20 2	18 7	31 0
,,	20 ...	31 1	31 5	53 9	28 6	25 8	32 2	19 11	18 6	30 7
,,	27 ...	31 3	31 4	54 3	27 6	25 7	31 11	19 7	18 8	30 6
Apl.	3 ...	31 4	31 6	54 6	27 0	25 6	31 9	19 2	18 5	30 6
,,	10 ...	31 3	31 5	54 9	27 8	26 8	31 3	19 2	18 4	30 4
,,	17 ...	31 6	31 7	55 4	26 11	25 4	30 10	18 10	18 4	30 5
,,	24 ...	31 8	31 9	56 5	26 7	26 6	31 5	19 3	18 5	30 11
May	1 ...	32 2	31 9	58 3	25 11	26 0	32 7	19 6	18 5	31 5
,,	8 ...	32 6	32 2	60 5	25 9	25 6	33 3	19 6	18 9	32 4
,,	15 ...	32 10	32 7	61 7	25 4	26 3	34 0	19 9	18 11	32 5
,,	22 ...	32 10	33 0	62 0	25 3	25 10	34 1	19 11	19 0	32 8
,,	29 ...	32 7	33 9	61 11	26 1	26 1	34 8	20 1	19 4	32 7
June	5 ...	32 10	34 0	61 9	26 2	25 11	35 4	19 8	19 4	32 5
,,	12 ...	32 8	34 1	60 1	24 7	24 11	34 5	20 2	19 8	32 4
,,	19 ...	32 8	34 1	56 1	23 10	25 10	34 3	19 8	19 9	31 9
,,	26 ...	32 8	34 3	52 0	24 3	25 4	34 4	19 1	20 0	31 9
July	3 ...	33 1	34 4	49 5	25 2	24 6	35 3	21 0	19 9	31 1
,,	10 ...	33 4	34 2	50 1	25 10	24 9	34 7	19 4	20 0	31 6
,,	17 ...	33 6	34 1	52 7	24 9	24 2	35 8	20 5	19 10	31 6
,,	24 ...	33 10	34 0	53 10	24 1	24 7	35 10	20 8	19 9	32 1
,,	31 ...	34 1	34 2	55 3	24 5	25 9	36 1	20 3	19 8	31 1
Aug.	7 ...	34 1	34 9	55 4	24 9	25 2	35 7	19 0	19 1	31 5
,,	14 ...	34 3	40 3	55 2	24 7	29 4	37 0	18 7	25 1	31 7
,,	21 ...	33 7	38 9	54 3	26 5	29 10	39 4	18 8	24 3	31 4
,,	28 ...	32 7	36 2	51 11	29 0	30 3	38 3	17 10	23 5	30 0
Sept.	4 ...	31 11	36 5	45 3	30 11	30 6	38 1	17 8	23 9	26 10
,,	11 ...	31 9	37 10	43 0	31 5	29 11	37 11	18 0	23 11	26 8
,,	18 ...	31 7	38 3	42 9	30 9	29 5	39 0	17 11	23 8	26 4
,,	25 ...	31 6	37 6	43 3	30 1	29 3	39 8	17 9	23 3	26 1
Oct.	2 ...	31 3	37 1	43 5	29 9	29 1	40 4	17 10	22 9	26 5
,,	9 ...	31 0	36 8	44 1	29 1	28 10	41 0	17 10	22 5	26 5
,,	16 ...	30 11	36 7	45 9	28 8	28 8	42 3	17 9	22 4	27 1
,,	23 ...	30 7	37 2	48 2	28 7	28 7	44 0	18 0	22 5	28 1
,,	30 ...	30 1	37 10	50 3	28 2	28 3	46 2	17 9	23 7	29 1
Nov.	6 ...	30 0	38 8	51 6	28 1	28 6	47 3	17 9	23 7	30 4
,,	13 ...	30 1	39 8		27 8	29 0		17 11	24 8	
,,	20 ...	30 4	41 0		27 5	29 8		18 1	25 5	
,,	27 ...	30 9	41 11		27 0	30 3		18 4	25 8	
Dec.	4 ...	31 2	42 2		26 8	30 2		18 4	25 9	
,,	11 ...	31 2	42 1		26 5	29 11		18 6	25 9	
,,	18 ...	31 2	42 7		25 11	29 8		18 5	25 9	
,,	25 ...	31 0	43 3		25 10	29 9		18 4	25 11	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of October, 1914 and 1915.

	WHEAT.		BARLEY.		OATS.	
	1914.	1915.	1914.	1915.	1914.	1915.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	38 10	48 2	29 8	45 5	24 4	29 8
Norwich	36 9	45 4	28 3	42 8	22 9	27 8
Peterborough	36 6	46 4	29 5	43 11	22 9	27 7
Lincoln	36 1	46 8	29 11	43 6	22 3	27 11
Doncaster	35 7	46 0	27 0	41 4	21 8	26 11
Salisbury	37 7	46 8	29 4	41 2	23 0	27 5

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